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INDIVIDUAL DIFFERENCES IN GRAMMAR GRADE CHILDREN

A Comparative Study of Forty-Four Seventh and Eight Grade Pupils

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SUMMARY

Twenty-two seventh-grade and 22 eighth-grade pupils were examined with respect to age, height, weight, strength of grip, quickness of perception, ability to add, ability to spell, rapidity of association, auditory memory, and visual memory with the following results:

1. There are the most surprising extremes of ability among children comprising the same school grade in every physical and mental trait examined in this study.

2. In not a single trait are the abilities of the entire group, or of either grade included in the group, distributed as in a normal frequency curve. There is no well defined "center of gravity" in any case.

3. The peculiar form of the surfaces of frequency of the several tests suggests the operation of some eliminating agency or agencies which make this group of pupils a selected group.

4. Neither grade nor sex seems to be responsible for the division of the group studied into smaller groups of more nearly equal abilities. The operative factors are probably indeterminate for so small a group.

5. In all traits examined, except those of age, height, weight, and strength of grip (in all of which nature's handicap of a year in favor of the eighth grade is still effective), the ranges of ability in the two grades are practically identical. There is no line of demarcation.

6. The principles on which the grading of our schools is carried out seem to be unrelated to all of the traits, physical and mental, here studied.

7. A rigid system of grading and promotion must work injustice to individuals, because the pupils of a given grade are not equally endowed in any one subject, and no one of them has the same rank of ability in all of the different studies of the grade. The least variation of ability found in any pupil was five different ranks in ten different traits. Since, under present conditions, grading is necessary, it should be made to depend on natural, rather than artificial, distinctions.

8. Every teacher should, at intervals, test all the pupils in his grade in as great a variety of traits, mental and physical, as possible, for the purpose of obtaining intimate knowledge of and correct insight into the individual qualities and weaknesses of his pupils. Such a means of comparison often explains difficulties and removes obstacles which must otherwise remain mysteries.

9. Emphasis on individual differences must not be interpreted as meaning that there are no qualities in common. So far as human relationships and social demands go, the most unlike people exhibit more similar than dissimilar traits and abilities. Recognition of individual differences in education should entail not so much the presentation of different subject-matter to different pupils as the affording of opportunity for individual reactions on the same subject-matter.

This study was originally undertaken as part of a course in experimental pedagogy in the Colorado State Normal School. It is presented here in somewhat detailed form for the twofold purpose (1) of suggesting a line of investigation which may be undertaken profitably by normal schools without extensive apparatus, and (2) of serving as a type study for the collecting and working up of the data of such investigations. Incidentally, it calls attention anew to the great variation in all forms of ability that exists in any group of children ordinarily treated alike.

The subjects of the investigation were 22 seventh-grade and 22 eighth-grade pupils (13 members of each class being girls),

who were occupying the same schoolroom under the instruction of the same teacher. The classes seemed as homogeneous as any school would furnish, and were in every way typical of their respective grades. The tests and examinations were all conducted by the teacher in charge of the grades and were regarded by the pupils as regular school exercises. With the exception of the physical examinations for height, weight and strength of grip, which were conducted individually, the tests were given as class exercises to the entire group at the same hour on successive days.

As representative of both mental and physical nature, of native and developed capacities, the children were examined and compared as to the following: (1) age, (2) height without shoes, (3) weight in indoor clothes, (4) strength of grip, measured by a Smedley dynamometer (12, 2d Report, p. 21) (5) quickness of perception, (6) ability to add, (7) ability to spell, (8) rapidity of association, (9) auditory memory, (10) visual memory. There are many other simple tests which would have served our purpose just as well, but these were chosen somewhat arbitrarily from the available list.

Method and Material of the Tests. Age, height, and weight require no explanation. In Test 4 the average was taken of four grips with the right hand (the left hand in the case of left-handed pupils) on a hand-dynamometer, after the child had familiarized himself with the instrument (12). In Test 5 quickness of perception was measured by the number of *A*'s crossed out of a page of continuous lines of capitals in 75 seconds (16, p. 4). For Test 6 the pupils were furnished with papers containing 20 problems in addition, each problem consisting of 5 numbers of two digits each; the number of correct sums obtained in two minutes determined the standing (15, p. 98). The spelling test included 50 words pronounced by the teacher and written by the pupils. The list of words used by Thorndike (15, p. 99) was adopted. Rapidity of association was tested by the much-used "association of opposites" exercise; a list of 48 adjectives and nouns, adapted from Thorndike (15, p. 99), was given the children, and they were required to write in one minute as many of the opposites of these words as possible. The memory tests consisted in the repro-

duction of the digits of a series of 10 numbers; the numbers ranged from 5 to 8 digits each; each series consisted of two numbers of 4 digits, two of 5, two of 6, two of 7, and two of 8. For auditory memory the digits were pronounced distinctly, in time with a metronome beating 75 times per minute; the pupils wrote the number from memory 5 sec. after the naming of the last digit; for visual memory the number was printed in large characters, and so exposed as to give $\frac{4}{5}$ sec. per digit. An interval of 5 sec. preceded the writing of the number. Each omission, insertion, substitution, or alternation of a digit was accounted one error (4 and 12). The per cent of error was estimated on the basis of 60 digits in the series of numbers.

The immediate results from even a superficial examination of the data revealed by these tests were startling, in spite of the suggestive discoveries of earlier investigators. The oldest child in the group was 6 years, $7\frac{1}{2}$ months older than the youngest, or more than one-half older; the tallest child was $13\frac{1}{4}$ in. higher than the shortest; the heaviest weighed 83 lbs. more than the lightest or almost $2\frac{1}{2}$ times as much; the strongest average grip was $2\frac{1}{4}$ times the weakest; the best speller was 74 per cent superior to the poorest; and so on through all the tests. And a further interesting point is that all these extremes except age lie in the same school grade, not as would be expected, the lower in the seventh, and the higher in the eighth grade. The minimal and maximal record in each test is given in the following table:

TABLE NO. I

Extremes of Ability in each Test

TEST	MINIMAL ABILITY	MAXIMAL ABILITY	AVERAGE ABILITY
Age	11 yrs. 8.5 mos	18 yrs. 4 mos.	14 yrs. 3.5 mos.
Height	4 ft. 6 in.	5 ft. 7.5 in.	5 ft.
Weight	71 lbs.	154 lbs.	101 lbs.
Strength of Grip..	20 kg.	45.5 kg.	29.9 kg.
Cancellation	39 A's	95 A's	60.25 A's
Addition	0 problems	9 problems	3.9 problems
Spelling	20 per cent	94 per cent	58 per cent
Association	0 associations	21 associations	11.5 associations
Auditory Memory	38.3 per cent	90 per cent	64 per cent
Visual Memory..	46.6 per cent	98.3 per cent	78.5 per cent

The Distribution of Abilities. But it is important not only to know the extremes of a given trait in a group of pupils, but also to discover how the pupils are distributed between the limits. The number of divisions which shall be made between the extreme records in any given test must be determined by the needs of the occasion and the nature of the data. In the present case it seemed desirable, for purposes of comparison, to have the same number of grades of ability in each of the ten traits examined, and the data of the several tests lent themselves best to a twelvefold division. Consequently, the interval between the best and the poorest record in each test was divided as nearly as possible into twelve equal parts[1] which served as the bases of distribution of the individual abilities between the two extremes. In order to avoid a misunderstanding of terms, throughout the remainder of this paper these divisions of ability will be spoken of as "ranks" and will be designated by the Roman numerals, I being the lowest rank and XII the highest. In the tables and figures the following abbreviations will be used to represent the respective tests: *Ag*-age, *Ht*-height, *Wt*-weight, *Gr*-strength of grip, *Ca*-cancellation of *A*'s, *Ad*-addition, *Sp*-spelling, *As*-association of opposites, *AM*-auditory memory, *VM*-visual memory.

The records for each test are now distributed among the twelve ranks of ability. In this first classification we pay no attention to the school grade of the pupil (*i. e.*, whether he is in the seventh or eighth grade), since we wish to study the group as a whole. But, since we shall have occasion to separate the two grades later for purposes of comparison, and since the second classification will show everything in the first, we proceed in Table II to give the results of the distribution by grades.

[1] The addition test, however, was a necessary exception. Since 9 problems was the best record and 0 problems the poorest, only ten grades of ability were possible. It seemes best, in spite of this condition, to retain the twelve divisions here also, and speak of the eleventh and twelfth as unoccupied.

TABLE NO. 2

Number of Pupils in Each Grade Who Fell in Each Rank in the Several Tests.

RANKS	GRADE	TESTS									
		Ag	Ht	Wt	Gr	Ca	Ad	Sp	As	AM	VM
I.	7	2	2	3	3	2	0	1	1	3	0
	8	0	1	1	2	1	1	4	1	1	1
II.	7	5	4	4	1	1	2	1	2	1	1
	8	0	0	0	1	1	2	1	1	0	1
III.	7	3	8	3	4	2	4	2	0	2	2
	8	2	0	1	5	3	4	3	0	1	0
IV.	7	2	0	8	5	3	3	4	0	1	0
	8	0	1	5	1	1	1	2	0	2	3
V.	7	4	1	1	3	4	6	2	2	3	1
	8	4	4	2	3	5	5	1	2	1	0
VI.	7	3	4	2	0	4	3	2	2	3	3
	8	2	2	3	0	5	6	2	2	6	2
VII.	7	2	1	1	2	0	0	1	3	2	3
	8	5	4	3	1	1	1	1	5	2	2
VIII.	7	0	1	0	0	3	2	6	6	2	1
	8	2	3	1	3	2	2	4	5	1	5
IX.	7	1	0	0	3	1	1	1	4	4	2
	8	4	2	2	2	0	0	1	2	2	3
X.	7	0	1	0	1	2	1	1	1	0	5
	8	1	2	1	1	1	0	0	2	4	1
XI.	7	0	0	0	0	0	0	0	1	1	2
	8	0	1	0	0	0	0	2	1	1	2
XII.	7	0	0	0	0	0	0	1	0	0	2
	8	2	2	3	3	1	0	1	1	1	3

If we combine the figures of the two school grades in Table II and reduce them to surfaces of frequency we get the graphic representations of the distribution of abilities throughout the various ranks shown in Fig. I. It will be noted that the base-lines are all equal and that each is divided into twelve equal parts representing the twelve ranks of ability in the several tests; the lowest rank is at the left, and the highest at the right end. For convenience in comparison a small "normal frequency curve" is given in the figure (*X*).

The most casual inspection of the diagrams of Fig. I reveals a remarkable lack of resemblance between the different surfaces and between each of them and the normal surface. There is hardly a single well marked "center of gravity," such as we should expect in the abilities of a group not specially selected. There is a decided tendency for the abilities to cluster in the extreme ranks rather than in a median position, as in a normal surface. This "end-heaviness" indicates that some selective agency has been at work and has eliminated the portion of the group which would have made the surface symmetrical (16). Surface *VM*. for example, suggests that the pupils belonging in the lower ranks of visual memory have been eliminated by failure in school requirements and held in lower grades; this group is therefore a selected one in regard to visual memory. Other peculiarities of this particular surface cannot be thus explained, however. And why has not a similar selective agency affected the Surface *AM*? I think the answer is that auditory memory has not the same intimate relationship to educational advancement as has visual memory. My earlier experiments on memory (4) would justify this conclusion. Just what influences have operated selectively in the several tests the limits of this paper will not permit us to inquire, if, indeed, the data at hand would enable us to decide.

Again, the broken and deeply incised outlines of most of the surfaces strongly suggest that this group of children is not homogeneous, so far as these tests are concerned. Some of the surfaces suggest two, and some three distinct groups of children. Surface *Gr.*, for example, indicates that in strength of grip these 44 pupils fall into three distinct classes; the largest occupies the

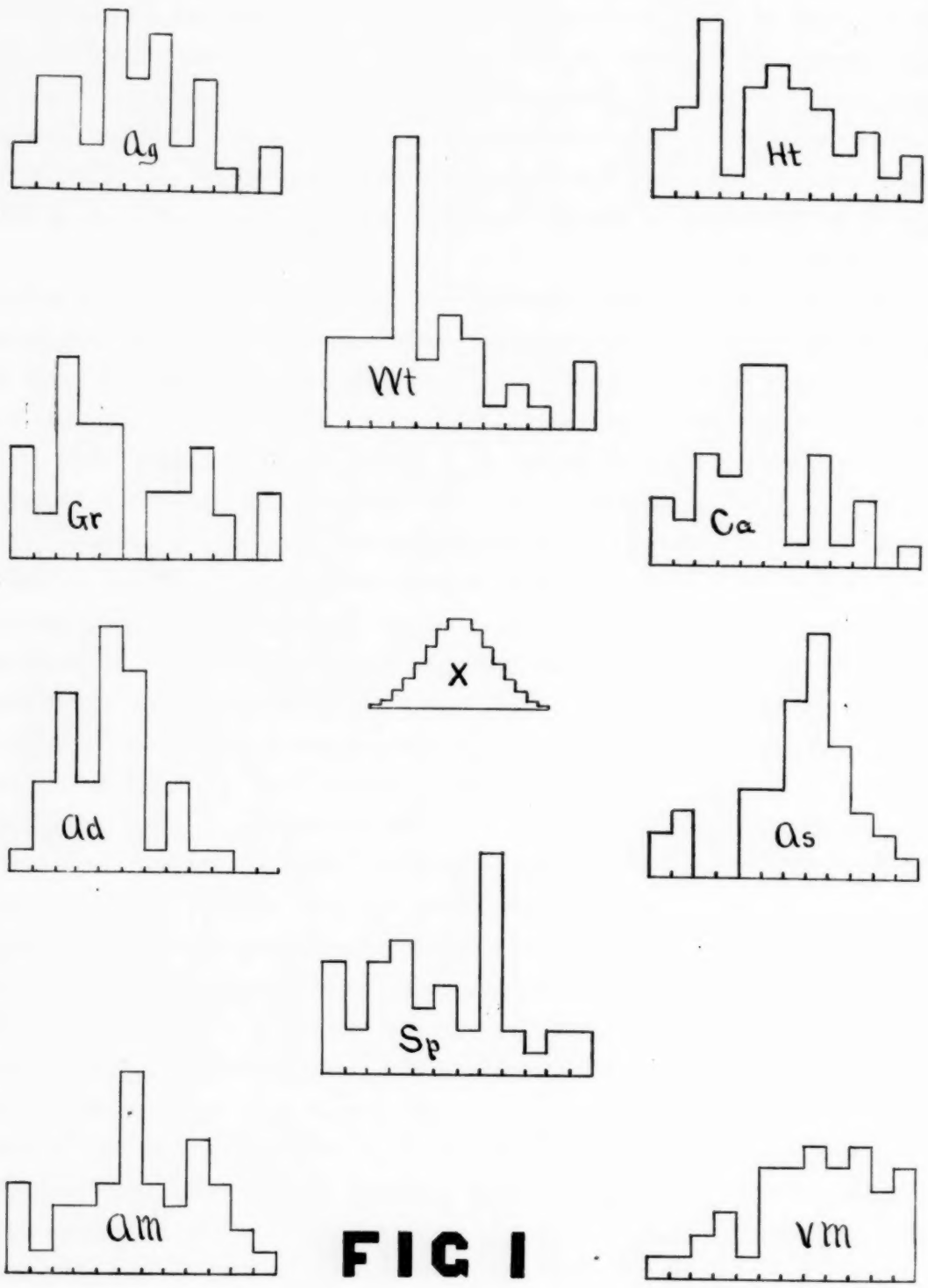

FIG I

five lowest ranks, a somewhat smaller one ranks 7-10, while three individuals belong together in Rank 12. Sex suggests a line of cleavage, but while most of the girls are in the lowest group there are a half-dozen boys there also. Other factors than sex must, therefore, be invoked in explanation.

One of the most obvious explanations to suggest itself is that, where a division occurs in the surface, the lower ranks are occupied by seventh-grade, the higher by eighth-grade pupils. In order to discover to what extent this is true, the data of table II, have been again reduced to surfaces of frequency with the two grades separate. In Fig. II, the surfaces of the two grades are constructed on the same base lines to make comparison easier. The plain lines represent the seventh, the other lines the eighth grade. From a single glance at these diagrams it is obvious that our expectation is not justified. In only the first four surfaces, those pertaining to age and physical characteristics due to age, do the eighth grade children occupy the highest ranks exclusively; and in all of these save the first they share the lowest ranks with the seventh grade children. And while, in the mental tests, there are 13 eighth grade children occupying the two highest ranks as opposed to 9 seventh grade children, the tables show that 21 eighth-grade and 70 seventh grade pupils occupy positions above the averages for the combined grades. Manifestly, an extra year of school life has failed to produce any discernible improvement in the traits tested. Indeed, in two of the abilities concerning which the public is most insistent as to the school's responsibility, viz. addition and spelling, the extra year in school seems to have produced a positive deterioration: in addition the lowest rank is monopolized by a single eighth grade representative while the two highest ranks are preëmpted by two members of the seventh grade. In spelling the lowest rank is occupied by *four* eighth and *one* seventh grade pupils, while the highest rank contains one from each grade. Since this eighth-grade was still reciting in arithmetic and spelling, we cannot justify their deficiency even on the principle of the boy who, when chided for using an adjective for an adverb, replied triumphantly that he had "passed grammar."

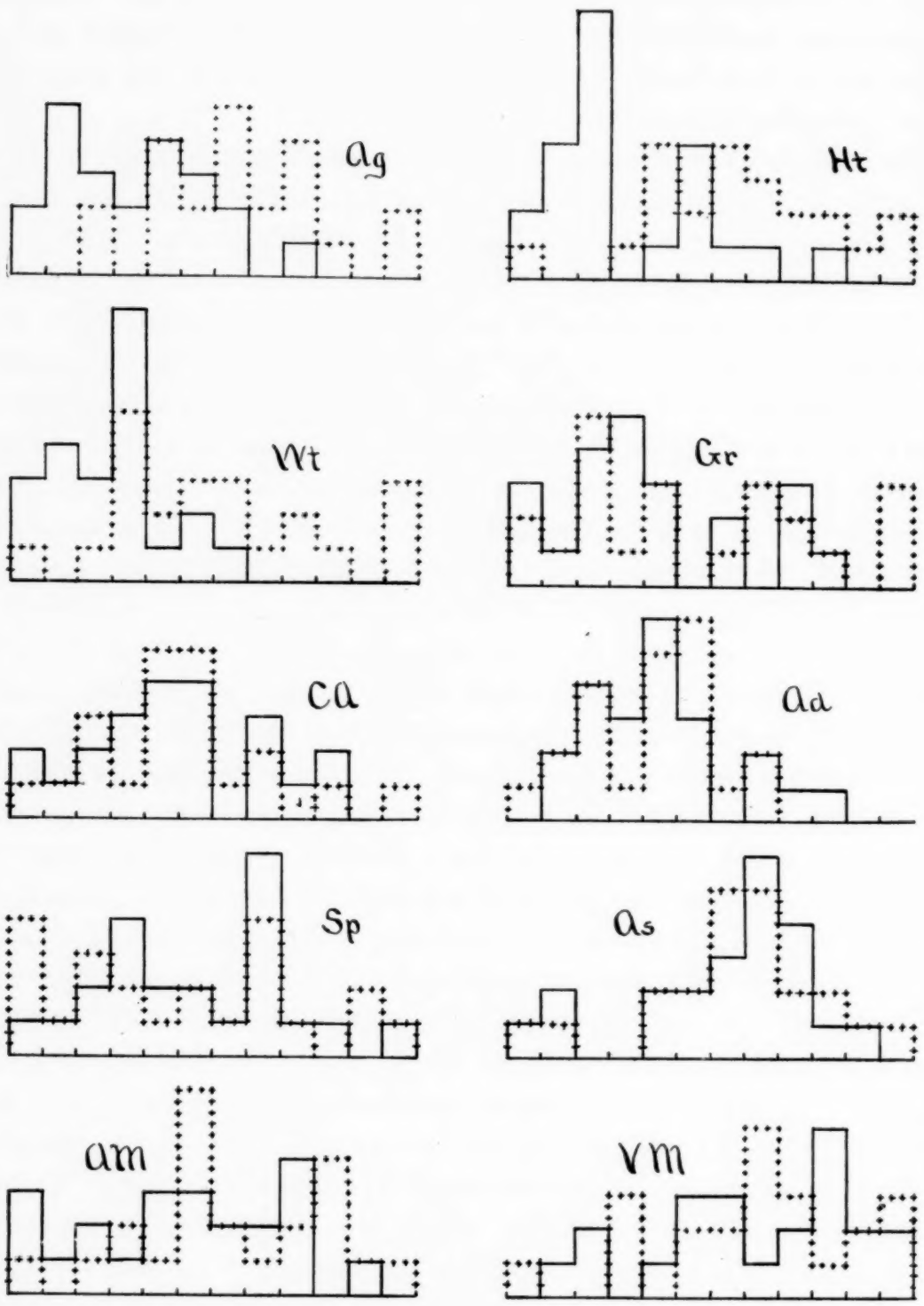

FIG II

The division of the surfaces of Figs. I and II into distinct groups must be explained, then, on some other basis than that of school grades. Referring again to surface *Gr*, it is seen that, while the highest separate part of the area contains only eighth grade pupils, the other two distinct groups are fairly evenly divided between the two grades. And, in the surfaces representing the mental traits, this distribution of the two grades is still more nearly equal. Considering the facts that there were among these children a few who were young and precocious, several who were old and well grown, but idle, a small group who were underfed and overworked at home, a large proportion of foreign parentage, and a considerable number who had entered the classes from other schools, the group of children contributing to this study was not so homogeneous as at first thought it appeared. There are probably a number of factors involved which would make the explanation of the irregularities of the diagrams next to impossible for so small a number of children.

The most important conclusion reached in the comparison of the distribution of abilities in the two grades is, then, that there is no line of demarcation between them; in regard to every trait examined the grades overlap and in regard to most traits they are co-extensive in their range. Hence, to assume that in two school grades we have two distinct species, that certain abilities are lacking in one and present in the other, that all the members of one class are of approximately equal ability in a certain field and that they are all inferior in that ability to all the members of the other, is, at best, a very hazardous guess. Indeed, by actual test, the poorest eighth-grade records in addition and spelling were surpassed by a third-grade child, selected at random. Teachers cannot afford to forget that our school grades do not represent distinct gradations of ability in the pupils, but are simply convenient devices of administration to facilitate the handling of children in the mass. The grades are determined by reference to more or less artificial standards, and too often do not represent the real intelligence, industry, endurance, adaptability, and other traits important for education, of the pupils. It seems as if ability in perception, association and memory, when

these functions are tested on familiar material, should be pretty closely related to educability, and should be affected by school progress to an extent distinguishable in successive grades, if the grades really grade. The standards of grading in present use are apparently as unrelated to the traits examined in this study, as are the same standards to work in physical training. It is rare, indeed, that classes in physical training are determined on any other basis than scholastic ability. Pupils who recite together in arithmetic also work together in the gymnasium. In physical training, if anywhere, it would seem an easy matter to grade and classify children on the basis of the traits to be developed by the training, *i. e.*, on the basis of physical condition and physical needs.

But, in one sense, the very principle of rigid grading is a psychological absurdity. The demand that all members of a class shall proceed at the same pace presupposes an equality of abilities which does not exist; the requirement that all shall meet the same standards of thoroughness and finish rests on the same fallacy; the practice of having those that are grouped together in one subject recite together in all subjects rests on the assumption that a pupil who maintains a given standing in one subject is able to maintain approximately the same standing in all subjects—an assumption which is by no means justified by the facts. Even in the light of conventional standards no mind is symmetrical, and it is the rare exception to find a student who occupies a corresponding rank in all his studies. In the present investigation, without exception, the abilities of each individual student in the different tests were found to be distributed through a considerable number of ranks. The student who showed least variation occupied every rank from IV to VIII inclusive. The others covered a wider range than this. In five instances a student found in the first rank in one test was found in the twelfth rank in another, with his other records scattered between the two extremes. So far as these tests are concerned there is little evidence of correlation of abilities.

In Fig. III are given graphic representations of the variations in the records of five pupils and also the comparative variations in

the average records of the two grades. In these diagrams the several tests are represented by the vertical lines (as shown at the top of the lines). Each line is divided into twelve equal parts to represent the twelve ranks of ability (as shown at the left). Diagram *A* shows that the eighth grade occupies a higher rank than the seventh grade in only the four physical tests and in auditory memory. In addition and spelling the seventh grade has a slightly better average, but still falls within the same rank

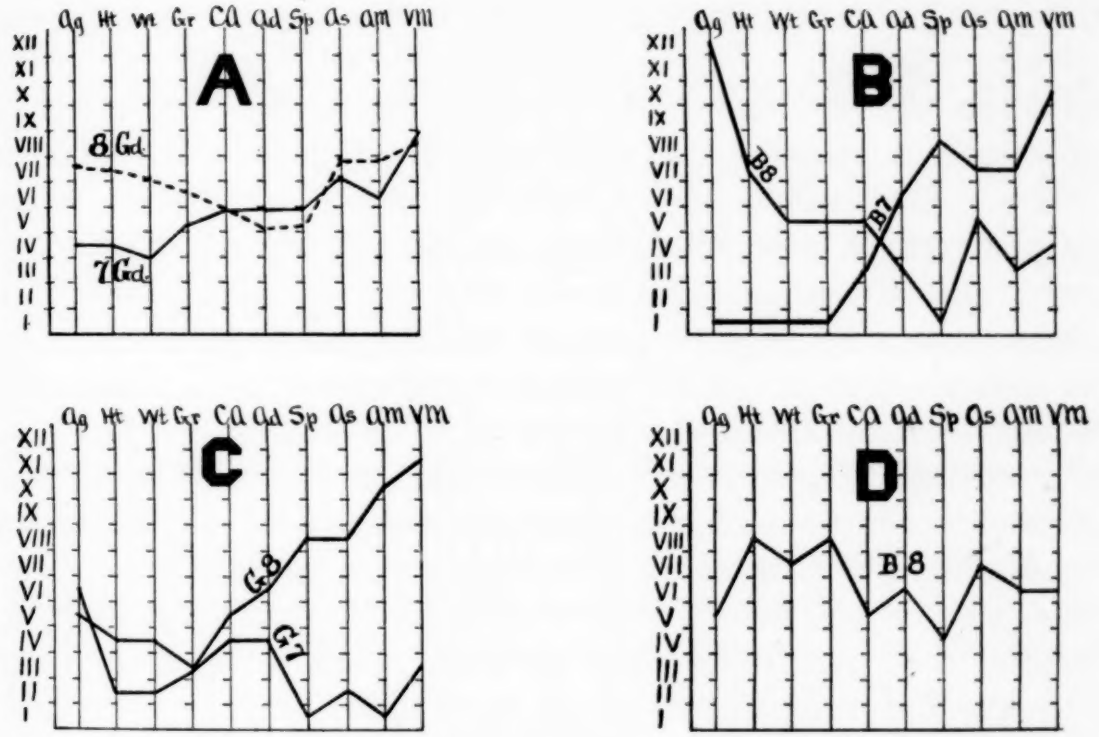

FIG III

as the eighth grade. In association the same is true of the eighth grade. In diagram *D* is shown the curve of the boy mentioned above whose various abilities showed the least variation. He was a vigorous well-fed country boy (it will be noticed that his height, weight, and grip rank higher than his age) whose mental abilities had kept pace with his bodily development, but who was in no sense precocious.

In Fig. III, *B*, are given the records of two boys, and in *C* the records of two girls. Curve *B8* is that of one of the oldest eighth-

grade boys, who had been retarded in his physical growth and whose physical retardation had produced a somewhat greater mental stagnation. Curve *B7* represents the smallest and youngest boy in the seventh grade; his precocity is shown by the fact that in each mental test he ranks above the expectation of his physical endowment. Curve *G7* is that of a seventh-grade girl whose physical retardation is accompanied by a corresponding inferiority in most of the mental traits tested. Curve *G8* is that of a healthy country girl in the eighth grade, who was just beginning her pubertal bodily growth, and whose standing in all her classes was high. Curves were constructed for all of the 44 children, but these are fairly typical of the whole. These curves have only a relative value under the conditions of this particular study. They would have a different form if a uniform system of percentages were substituted for the arbitrary "ranks" here used. But there can be no doubt that, to a teacher of these children, such a set of curves would afford valuable suggestions as to modifications of subject-matter and method, or at least as to traits to be watched and experiments to be tried.

President Hall's classic study long ago showed the prime necessity of exploring the contents of children's minds on entering schools in order to secure a sound apperceptive basis for instruction. Have not subsequent investigations sufficiently demonstrated the equal necessity of frequent tests of a wide range physical and mental traits whose results may serve as suggestion for grading, for the development of special interests, for the removal of special weaknesses, and for the adaptation of educacational processes generally to the special needs of individual pupils? The study of individual differences has only begun. The possibilities of this field for practical education are only dimly realized. Education is an individual as well as a social process, and its future progress must depend at least as much on the results of investigations of individual differences as upon the facts of common traits and social instincts which have been so strongly emphasized in recent years.

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THE POINT OF VIEW OF GENETIC PSYCHOLOGY

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The word genetic has been used in connection with psychology for a number of years but its exact significance has not been well defined. The word genesis means, "an account or explanation of the source or origin of anything," and the word genetic, "of, pertaining to, dealing with, or based on genesis." This is the meaning to be associated with the word genetic, when it is applied to psychology.

The old time introspective psychologist did not produce a genetic psychology so long as he simply looked into his own consciousness and reported what he found, with classification and generalization as to the nature of mental states and their relation to each other. The experimental psychologist who observes mental states under definite conditions, and finds, so far as possible, objective indications or measures of those states does not produce genetic psychology. The application of statistics to introspective and experimental facts changes the nature of the psychology only in the way of making it more universal and exact. The physiological psychologist who attempts to determine the character of the physical structure and processes concerned in mental operations, produces a non-genetic psychology.

As soon, however, as the introspective psychologist begins to inquire how his present mental states originated and to trace them back to their beginnings, his psychology becomes genetic. When the experimental psychologist begins to investigate the processes of development by which, under given conditions, present degrees of mental activity have been reached, his psychology also becomes genetic. The physiological psychologist in like manner takes

the genetic point of view when he begins to inquire how the various sense and nerve structures came to have their present form and their present relation to each other.

The comparative psychologist has not the genetic point of view so long as he simply compares different species of animals with each other and with human beings of different races in respect to the nature and degree of their intelligence. Nor does the social psychologist belong to the genetic type, so long as he considers social phenomena as they are now manifested, without reference to their beginnings. Psychology of every type becomes genetic in proportion to the degree to which the search for origins is made prominent and carried back farther and farther toward ultimate beginnings. The old introspective psychology, which recognized perceptions as having their origin in repeated sense experiences, and concepts as resulting from many percepts, could scarcely be called genetic, because the study of the process of change was not emphasized and the resulting higher mental activities were considered as of much greater importance than the beginnings of mental life, and the stages of development by which these activities were reached.

The recent careful and extended studies of learning processes are, to a limited extent, genetic in character, for the *changes* that take place with practice under definite conditions are made prominent, rather than the *results* of the learning processes. Yet the search for the beginnings of the process is not carried back very far, since it usually extends only to the conditions found at the beginning of the experiment. In some of the biographical and individual studies, the development is traced very much farther back in the life of the individual, and the explanation of present conditions is found in early predispositions or in environing influences and special experiences.

In child psychology, or as it is more commonly called, child study, the search for beginnings is carried back still farther to the reflex and instinctive tendencies that are the race inheritance of all human beings, and the attempt is made to trace the development of these tendencies from the earliest years to maturity under the various conditions to which children are subjected.

When the attempt is made to go still farther back in the search for origins and find how the various characteristics of human beings arose, by studying similar characteristics in creatures of a lower type, we have a psychology that is genetic, in the special sense now beginning to be recognized as indicated by the name.

There is good reason to believe that the laws governing the changes from a lower to a higher type of mental activity are to a considerable extent similar, whether the process is one of learning by adults, of development in children or of evolution of racial characteristics. Hence the study of any form of developmental change throws light on all other forms of genesis. It appears, therefore, that every variety of psychology that concerns itself especially with changes from a lower to a higher type of activity is genetic in character, but that the special body of knowledge designated by the term genetic psychology is concerned particularly with the more ultimate and evolutionary study of the beginnings of mind in the lower organisms, and in tracing the development of consciousness from lower to higher forms in the race.

There is really, however, not much more occasion for using the term 'genetic' psychology, than there is for using the term 'genetic' botany, or 'genetic' zoölogy. We do in those sciences sometimes use the term 'evolutionary' botany or zoology, with practically the same significance as we use the term 'genetic' psychology. In botany and zoölogy, however, the term is used not so much to indicate a separate body of knowledge, as to indicate a point of view and a method of studying the phenomena in question. This is also to some extent true of the term genetic psychology and in this more general sense it will probably continue to be used as long as is necessary. It seems to the writer, however, that all psychology must ere long become genetic in point of view and in ways of interpreting facts. Psychology will then be regarded as the apex of the biological sciences and, as in other cases, the biological point of view will naturally be assumed. If this should be the case, there will be no occasion for using the term genetic psychology in a general sense, but only in the special sense to indicate the body of knowledge concerned with the evolution of mind in the race.

It is not, however, simply from the study of biology, that we are led to believe that all psychology must become genetic in character. The more we study the nature and functions of conciousness the more are we impressed with the truth that consciousness is most prominent and useful when changes are taking place. It has little or nothing to do with fixed reflexes and well established habits. It becomes prominent in connection with all new activities and gradually disappears from those activities as they become uniform in character. Any given state of consciousness, viewed by the psychologist, can only be the result of a long series of processes in which one phase or kind of activity after another came into consciousness and then dropped out of consciousness. No study of consciousness as such can, therefore, be scientific which does not regard it as a phenomenon of change and which does not seek to find the explanation of present conditions and future changes in the changes that have previously taken place.

From the point of view of practical application also the genetic feature must always be made prominent. The educator and the moralist are concerned ultimately, not with what is, but with what may be, and this can only be determined by considering what has been, and what laws govern all mental changes. The usefulness of every employee and public servant is to be determined, not simply by what he is, but by the consideration of how quickly and easily he may be made to progress toward what is desired. All standards or norms determined by experimental and statistical researches are of practical value only in so far as the norms have been determined for a group of people of the same general type, with equal opportunity for acquiring the characteristics that have been measured.

It appears from the preceding discussion that genetic psychology, the babe of the psychological family (for which the writer is now acting as god father), is likely to inherit all the accumulations of its parents and brethren and completely dominate, as babes sometimes do, the whole household.

Already the more distant relatives, such as ethics, pedagogy and logic, and even the hoary headed old grandfather philosophy, are beginning to feel the influence of this youngster, and ideas and

ideals of the absolute and unchangeable are giving place to ideas and ideals of the constantly changing, and the ever progressing genesis of the new and better.

The genetic idea will not be understood unless we realize very fully that the changes in the process of genesis are not merely the result of combining elements that remain the same. On the contrary the progress of genesis in organisms and in mind is one in which new characteristics are constantly appearing, so that both whole and parts that are called by the same name are really different in each stage of development. No mental state is the sum of the experiences giving rise to it, just as no vegetable is the sum of the chemical elements of which it is composed.

In this journal it may be worth while to point out more definitely the relation of genetic psychology to educational problems. The older psychologists in considering educational problems, if they did not take the extreme logical view that children should be taught in accordance with the modes of thinking and working suited to the highly developed logical procedure of the specialist, assumed at least that the child's mode of thinking and learning was like their own. This assumption genetic psychology shows to be far from the truth. All research concerning learning processes shows that, even in the case of adults, the beginner in any line does not continue to work in the same way, but that his mode of performing the task is constantly changing, until he has completely learned it. The process of learning is to a considerable extent a process of development and it is utterly impossible to use the methods of the expert in the earlier stage of learning. This has been clearly shown in penmanship, in typewriting and in telegraphy; and tests of arithmetical prodigies and their modes of working as compared with those of ordinary individuals indicate the same truth. When we come to compare the modes of thinking and solving problems used by an adult with those of a child who is trying to deal with the same question, the differences are still more marked. Not only does the adult know more of the particular problem but he has acquired sufficient experience and knowledge to enable him to use more economical methods of procedure than are possible for the child. This fact

that the developing mind cannot function successfully in the same way as do the minds of experts is one reason why the child in the period from two to three years makes, without any specific teaching whatever, more rapid progress in the acquisition of language than is ever made by college students who are taught according to the most approved theories of the older psychology.

The child differs from the adult not only in experience but also because he is in many respects different in his nature. In his early years many of his activities and mental states are more similar to those of higher animals than they are to those of adult human beings. A study of how a dog or cat or bird learns may, therefore, be more helpful in showing how a young child learns and should be taught, than the most careful study of the mental processes of adult human beings.

According to the genetic point of view the mind of the child and every idea in it goes through a process of development, and any attempt to quickly mold the mind or even a single idea of a child into the mature form is sure to fail. The teacher can only do what the gardener does, make the external conditions favorable, supply the proper material for development, and give the necessary stimuli to activity, which in the case of plants are chiefly thermal and in the case of human beings, social. Methods of teaching evolved in the minds of the old time psychologists are, therefore, usually worse than no method at all, since they distort and retard rather than hasten a more perfect development that would otherwise take place in good time.

Genetic psychology demands a complete change in educational theory, not only in ideals as to what a child should study at different stages of development, but also as to the methods by which both children and adults are taught. It demands that, instead of attempting to teach at once methods of working that are suited to the expert, a study of natural methods of learning shall be made and experiments carried on to determine what methods will be most effective in teaching the learner to pass from the crude efforts of the beginner to the accurate performance of the expert. It will be necessary to make a study of learning processes not only

in adults but in children at different stages of development, and also of animals of different grades of intelligence.

Genetic psychology must, inevitably therefore, not only change the point of view of the educator, but greatly increase and complicate the problems which he must meet in arranging courses of study and methods of teaching children of different ages. This change in point of view on the part of educators is now rapidly taking place, and would have proceeded much faster had it not been for the influence of non-genetic psychology, upon which educators tried to found the science and art of education, in spite of the fact that they were continually finding the results unsatisfactory.

SOME MEASUREMENTS OF MENTAL FATIGUE IN ADOLESCENT PUPILS IN EVENING SCHOOLS

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(*Continued from the January number.*)

PART II

I can, however, at this point, hear experienced teachers say, "Yes, of course—a two-hour session—all mathematics—we do not wonder at it." So I turned my attention next to a class which atten ed for one hour per evening only.

(II.) *With a Class of Telegraph Messengers*

This was a quite exceptionally homogeneous class of growing lads employed as telegraph messengers, who were preparing in their evening class for the sorter's examination held by the postal authorities. This, too, may be looked upon as a class in which there is a form of indirect compulsory attendance at evening school. All the lads do not leave off work early enough to commence attendance at the beginning of the session, namely, 7:30 p.m.; in fact, they have a special hour of attendance of their own, namely, from 9 p.m. to 10 p.m.

The general method adopted was as before. The class was divided into two equal groups and then, on subsequent evenings, one group worked an exercise at 9:03 p.m. and the other group the same exercise at 9:33 p.m. The difference in the work will afford a measure of the difference in mental power as the session wears on, provided, of course, that all the students give their fullest attention to the work. With these students, unlike the previous case, it was felt that there was a kind of competition between Groups A and B, but the purpose of the experiment was not, of course, made known to them.

The exercise on which the division was based was one in "substance" memory. At 9:05 p.m. on November 17, 1908, the students were asked

to memorise visually as much as they could of a passage from a book previously unseen. They were told that they would be required to write out afterwards as much as they could remember, and careful explanation was given to the effect that the *words* of the book were not required, though there was no objection to their use. The students were also told that it was permissible to insert anything at the conclusion of their exercise which they found, on reading through, they had omitted.

Ten minutes were allowed for memorising the passage which follows, and twenty minutes for writing out afterwards what was remembered.

PRELIMINARY EXERCISE

While there are some districts, chiefly in the west and north of the country, in which mountains and hills may be said to prevail, the country may be described, in general terms, as level and fertile. Almost everywhere, the eye rests upon the evidences of long continued cultivation, on rich cornfields and meadows, surrounded by well-trimmed hedges and rows of trees. The elm-surrounded Gothic parish church, the clean village cottages with their honey-suckled porches, and the well-wooded parks, with the residences of the noblemen and gentry, are other notable features in the landscape.

Turning from rural scenes, we see striking evidences of an advanced civilization in the frequent brick-built towns, often overhung by clouds of smoke, resulting from the coal, everywhere used both for domestic and manufacturing purposes. The peculiar features of some of these cities, such as Liverpool, Hull and Bristol, vast ports for merchant shipping, Manchester, Birmingham, Leeds and Sheffield, seats of extensive manufactures, and London, the greatest port and manufacturing city of them all, will be alluded to later on.

To the method of marking, I invite the Society's attention, as I believe it enables us by "objective" methods to get as exact values for substance memory as we have hitherto done for the rote memory of meaningless things. It is possible for one who has had much practice with school children of various ages to make *a priori* an approximate division into units; but such a division is never more than approximate. The basis of division is found in the papers themselves. If, in any group, any member of the group divides in two what, in our

analysis, is unitary, the analysis is amended and two marks allotted, one to each item. We aim to find out what goes into and out of consciousness together; these syntheses we call units, and these differ, of course, according to the mental level we are experimenting with.

The only difficulty in the matter is the great laboriousness of the undertaking, since the same set of papers must often be marked many times before we find that the above basis of marking has been strictly adhered to. We sail gaily along for a while, and presently find someone who has divided an idea which to us seemed unitary. He has remembered one element and forgotten the other; so this at once alters our analysis, and sends us back through all the papers we had already marked. Very roughly we may say that, to pupils of these ages, subjects, predicates, and objects or purposive extensions are remembered together; adjectives and adjectival phrases, adverbs and adverbial phrases, and connecting words form units by themselves.

Let me present a piece of analysis commencing at the beginning of the second paragraph.

This gives a total of 13 units. The *rural scenes* had been described in the preceding paragraph; the adjective "rural" does not in this case carry an additional mark.

One further question arises. How far must variation from the text

proceed before we decide that the idea is not remembered? Well, there is no difficulty where we ourselves would accept the substitution as equivalent. But where we should not, what then? In that case we find out by careful non-suggestive questioning whether the ideas are equivalent in the mind of the pupil. If they are, we allow the mark. "Some" and "many," for example, to large numbers of school children, are interchangeable terms; and, in marking for substance memory, we must accept all terms as equivalent which, in their minds, are thus interchangeable.

The papers were marked by two persons independently, the teacher of the class, and the head of the evening school; doubtful points were decided in subsequent conference with me.

The results of the preliminary exercise follow:

TABLE V

Showing the Marks Gained in the Preliminary Exercise in Substance Memory

NAMES INITIALS ONLY	AGE	MARKS	NAME INITIALS ONLY	AGE	MARKS
J. G.	18	48	L. E.	16	33
P. H.	16	45	W. S.	14	32
S. B.	15	44	A. S.	15	30
T. G.	15	41	W. W.	14	29
J. D.	14	41	C. S.	14	27
H. T.	18	41	S. C.	14	21
H. P.	19	41	C. W.	15	19
H. T.	14	40	J. C.	17	15

The class was then divided into two equal groups as follows:

TABLE VI

Showing the Division in Two Equal Groups

Group A			*Group B*		
NAME INITIALS ONLY	AGE	MARKS	NAME INITIALS ONLY	AGE	MARKS
P. H.	16	45	J. G.	18	48
S. B.	15	44	J. D.	14	41
T. G.	15	41	H. T.	18	41
H. T.	14	40	H. P.	19	41
W. S.	14	32	L. E.	16	33
W. W.	14	29	A. S.	15	30
S. C.	14	21	C. S.	14	27
C. W.	15	19	J. C.	17	15
Total		271	Total		276

The next exercise was taken on December 1, 1908.

Those in the first section commenced to memorise at 9:03 p.m., those in the second section at 9:33 p.m. Ten minutes were allowed for memorising as before, and twenty minutes for writing out what was remembered. Whilst the first section were at work on the exercise, those of the second section who were present (four only) were engaged in transcribing geography notes and entering names from the atlas on blank maps—work by no means fatiguing in itself. The lads had not been told that they were to be required to do any special work, and busy times had set in at the Post Office, so that only twelve of the sixteen were present.

The exercise given was the following: It was, as will be seen, much more difficult than the first.

FIRST FATIGUE EXERCISE

The fisheries of England are very important. It is stated that about fifty thousand people are engaged in this industry, and that fish to the value of over four millions sterling is sent to British markets annually, not to name our exports.

The great central fish market of all England, is London; and, not only many English counties, but some continental countries, obtain more or less of their supply from Billingsgate, the chief fish market of the city. The North Atlantic Ocean is richer, both in the quantity and quality of its edible fish, than any other portion of the waters of the globe; and of the whole North Atlantic, the North Sea is one of the richest parts. It abounds in shoals and banks, the resorts of fish, the chief of which will be here mentioned.

The Goodwin Sands, off the coast of Kent, provided a lurking place for fish, of which the hardy boatmen of Deal and Ramsgate are not slow to take advantage. Off the coast of Norfolk are the celebrated Yarmouth Sandbanks. Further to the North is the extensive Dogger Bank, stretching across the North Sea, beginning about twelve miles from Flamborough Head, and extending about two hundred miles toward the coast of Jutland.

The papers were marked as before, and the results follow:

TABLE VII

Showing Marks of Preliminary Exercise and Marks for First Fatigue Exercise of the Two Equal Groups A and B

Group A. 9:03 p.m.			*Group B. 9:33 p.m.*		
NAME INITIALS ONLY	MARKS FOR PRELIMINARY EX.	MARKS FOR FIRST FATIGUE EX.	NAMES INITIALS ONLY	MARKS FOR PRELIMINARY EX.	MARKS FOR FIRST FATIGUE EX.
P. H.....	45	26	J. G.....	48	28
S. B.....	44	25	J. D.....	41	absent
T. G.....	41	24	H. T.....	41	absent
H. T.....	40	25	H. P.....	41	18
W. S.....	32	25	L. E.....	33	22
W. W.....	29	25	A. S.....	30	17
S. C.....	21	18	C. S.....	27	absent
C. W.....	19	14	J. C.....	15	absent

Every pupil has gone down; a result due to the great difficulty of the exercise. P. H. has gone down 42 per cent., the corresponding lad in Group B, J. G., has also gone down 42 per cent.; whilst H. P., L. E. and A. S. show a marked falling off as compared with the pupils in Group A who were level with them in the preliminary exercise. Omitting the four absentees in Group B and the corresponding pupils in Group A, we find that, whilst Group A, which scored 146 marks in the preliminary, now scores 101, Group B., which scored 152 in the preliminary, now scores 85 only.

The teachers, however, felt that, with half of the second group away, our experiment could not be regarded as conclusive, so we determined to try again. Since J. D., H. T., C. S. and J. C. had missed an exercise, their condition as regards improvement by practice would be different from that of the corresponding pupils in the other group, and so we should get an erroneous result if we included them. But, by transferring T. G. and C. W. to the B Group, and leaving out all the unpracticed pupils, we succeeded in getting two equal groups for our final exercise. The teachers thought we should tell the lads we wanted them to come for an experiment, so we told them that it was for a memory competition—Group A against Group B. We had no absentees next time; the boys seemed as interested as if they had been coming to a football match.

The final exercise was given on Monday, December 7. Group A began at 9:05 p.m. and Group B at 9:35 p. m. Warned by our experience with the second, we made this easier, but still knowing how

rapidly exercise improves memory, we judged that, it would be well to make it harder than the preliminary exercise, if we wished to get a clear difference between Groups A and B. As it was thought that some relevant fatigue might have been produced by the preliminary geography at which Group B worked before taking the exercise, which was itself geographical, this group, on this occasion during the first half-hour, worked a set of easy proportion sums, such as are required for their sorters' examination.

SECOND FATIGUE EXERCISE

The arable land of Scotland, which covers no more than a third of the whole surface, chiefly lies in broad valleys sloping towards the sea-coast, known as glens and dales. The less steep hilly districts are chiefly sheep-walks and cattle pastures. Timber, which once covered a large portion of the surface, is now chiefly confined to the neighborhood of gentlemen's and noblemen's dwellings, and to plantations which have been raised within the last hundred years to protect arable lands from the cold winds.

To the north of a curved line drawn between Glasgow and Aberdeen, the country is more mountainous than elsewhere, and is therefore called the Highlands. This is a district full of romantic scenery, consisting of rugged, gloomy mountains, lonely lakes, rushing streams, and wild natural woods.

The time for memorising and the method of marking were as before. The results follow:

TABLE VIII

Showing the Marks Obtained in the Preliminary Exercise, and the Marks Obtained in the Second Fatigue Exercise of Groups A and B

	Group A.			*Group B.*	
	9:05 p.m.	*9:05 p.m.*		*9:5 p.m.*	*9:35 p.m.*
NAME INITIALS ONLY	MARKS FOR PRELIMINARY EX.	MARKS FOR SECOND FATIGUE EX.	NAME INITIALS ONLY	MARKS FOR PRELIMINARY EX.	MARKS FOR SECOND FATIGUE EX.
P. H.....	45	40	J. G.....	48	37
S. B.....	44	36	T. G.....	41	23
H. T.....	40	33	H. P.....	41	27
W. S.....	32	40	L. E.....	33	18
W. W.....	29	40	A. S.....	30	28
S. C.....	21	25	C. W.....	19	20
Totals.....	211	214	Totals.....	212	153

I venture to suggest that this is a most striking result. Group B is slightly the stronger group, yet half an hour's difference in the time of the second fatigue exercise produces a difference of 28 per cent. in the results; whilst a still more conclusive inference can be drawn from the fact that, in every instance, the lad in the 9:35 group does much worse work than the corresponding boy in the 9:05 group. And in this case we cannot argue that the falling off is due to one kind of lesson being continued too long, as might, perhaps, have been the case with the artisan class in workshop arithmetic.

We are driven to the conclusion that these pupils are so little fit in the evening for mental work of any difficulty that half an hour in class, after the work of the day, is sufficient to produce fatigue. This class attends a school which has the best ventilation—open fire and open windows,—is a one-floor school, and is situated among fields and open spaces; the hygienic conditions of work are admirable, yet in half an hour mental energy is fast sagging away. Those in this Society who know my work on fatigue in day schools will know how very, very different are the 12 o'clock and 4:30 p.m. results from these. If fatigue exists at all at those hours, it is quite insufficient to mask a steady improvement by practice. Whereas, in the latter part of the evening school session mental energy seems so low that improvement by growth (for these are all young people) and by practice does not appear at all.

(iii) *With Classes of Mixed Occupations*

I have given the results of work done in two homogeneous classes in two schools, one situated in a manufacturing neighborhood, and one in a suburban-residential neighborhood. I turn now to experiments conducted on the same general plan in a school containing mixed classes, the pupils of which attend for the purpose of preparation for, or becoming more proficient in, the lower grades of clerical work.

a. In Numerical Computation (Males and Females)

On November 4, at 8:30 p.m., halfway through the evening school session, the following exercises were given to a mixed class who came

for a two-hour lesson in arithmetic. Half an hour was allowed for the work; the marks for a perfectly correct solution are given in brackets after each sum. For an error in one or two figures only, in any one sum, one mark was subtracted; further inaccuracy involved the loss of all the marks given for that sum. I have worked out a much more satisfactory system of units for sums of this kind, but the marking would have been too laborious, and not known to the teacher, who, of course, preferred to mark in his own way. And, as I intended these exercises only as a less exact test to see whether the results of the rigorous and definite exercises previously described were borne out in the main, I thought that a less degree of statistical regularity would suffice.

PRELIMINARY EXERCISE

(1) 7,268,514,268 ÷ 6, 7, 8, and 9. (10)
(2) 7,268,514,268 × 6, 7, 8, and 9. (10)
(3) £5 4s. 6¼d. × 365. (10)
(4) £2,318 17s. 9¼d. ÷ 139. (10)
(5) £2,318 17s. 9¼d.; reduce to farthings. (5)
(6) L. C. M. of 2, 9, 34, 51, 21. (5)
(7) G. C. M. of 209, 1241, and 7373. (5)
(8) Simplify $\frac{1}{4} + \frac{7}{8} + \frac{2}{7} + \frac{1}{3}$. (5)
(9) £12,000 6s. 8¾d. − £10,565 13s. 4d. (5)
(10) 29,156 × 396. (5)
(11) 482,396 ÷ 760. (5)
(12) 2,864,597 − 1,995,469. (5)
(13) $\frac{5}{8} + \frac{2}{3} + \frac{1}{10} + \frac{3}{11}$. (5)
(14) 123,456,789 ÷ 9. Then each successive answer by 8, 7, 6, 5, 4, 3, respectively. (10)
(15) $\frac{5}{8} \times \frac{2}{3} \times \frac{5}{6} \times \frac{8}{9} \times \frac{6}{7} \times \frac{5}{8}$. (5)

The students were then divided into two approximately equal sections and, on November 18, one group worked the following exercise at 8 p.m. and the other at 9 p.m.

FINAL EXERCISE

(1) 62,859,378,453 ÷ 6, 7, 8 and 9. (10)
(2) 62,859,378,453 × 6, 7, 8 and 9. (10)

(3) £765 13s. 7¾d. × 365. (10)
(4) £2,814 14s. 5¼d.; reduce to farthings. (10)
(5) £2,814 14s. 5¼d. ÷ 187. (5)
(6) L. C. M. of 5, 17, 102, 35, 21. (5)
(7) G. C. M. of 366,654,339. (5)
(8) Simplify $\frac{1}{3} - \frac{3}{18} - \frac{5}{12} + \frac{19}{24}$. (5)
(9) £70,253 13s. 5½d. − £12,345 13s. 8¾d. (5)
(10) 7,854,523 inches to miles. (10)
(11) 3 qrs. 17 lbs. 11 oz. 7 drs. × 35⅔. (10)
(12) 97,654 × 78,065. (5)
(13) 394,959 × 476,787. (5)
(14) 7,300,400,029 ÷ 236,421. (5)
(15) £341 1s. 8¾d. + £6,132 6s. 5½d. + £2,748 19s. 11¾d. + £1,249 12s. 8½d. (5)

It will probably be sufficient in this case if I give one table showing the results of all the work together.

TABLE IX. (MALES AND FEMALES)

Showing the Comparative Results of the Work of Groups A and B in Numerical Computation

GROUP A					GROUP B				
NAME INITIALS ONLY	AGE	OCCUPATION	1ST. EX. 8:30 P.M. 4/11/08	2D EX. 8 P.M. 18/11/08	NAME INITIALS ONLY	AGE	OCCUPATION	1ST. EX. 8:30 P. M. 4/11/08	2D EX. 9 P. M. 18/11/08
W. A.	16	Telegraph messenger ..	73	88	Q. W.	16	†Clerk.....	80	72
S. A.	18	Telegraph messenger ..	43	‡19	C. J.	15	Warehouse boy ..	53	36
O. J.	17	Laboratory assistant ..	35	39	P. E.	14	Clerk.....	38	28
*H. E	15	Typist	31	32	*K. E.	14	None.....	33	39
O. W.	14	Clerk	28	16	K. Ed.	15	Clerk.....	31	11
G. G.	18	Telegraph messenger ..	26	36	B. A.	14	Clerk.....	29	51
L. J.	15	Clerk	21	32	H. F.	14	Clerk.....	23	12
E. W.	16	Telegraph messenger ..	16	11	B. A.	14	None.....	16	17
*M. A.	16	None	12	16	M. E.	15	Engineer.....	7	17
			285	289				310	283

* Females.
† Clerks may be office boys, who frequently describe themselves as clerks.
‡ S. A. arrived late on November 18; he was obviously "rattled" the teacher thought, so that the 19 marks by no means represented his usual work.

All the members of Group A, except two, show improvement on their first exercise; whereas, in Group B, four only show improvement, whilst five show a very marked decline even on their own previous record. This is certainly remarkable in an exercise like this, which is extraordinarily susceptible to improvement by practice. Moreover, comparing Group A with Group B, we find that, whereas the second group started 25 points above Group A, it finished 6 points below, and had not S. A., through his lateness and agitation, belied his usual record, would have finished some 35 points below.

Thus, once again, we see a serious falling off in power as the session proceeds, even in such purely mechanical work as numerical computation.

Is it merely accidental that all the pupils marked as of no occupation show improvement in the second exercise even in the cases in which the second was done at 9 p.m.?

b. In Elementary Shorthand. (Males)

At 8:30 p.m. on November 2, the following exercise was given to a class in elementary shorthand:

PRELIMINARY EXERCISE

Exercise from Pitman's *Teacher*

Transcribe from Shorthand to Longhand

Ex. 2. Consonants.
Ex. 4. Joined consonants (lines 2, 4, 6).
Ex. 6. Joined consonants *ch* and *r* strokes (2, 4, 6).
Ex. 8. Joined consonants. More than two.
Ex. 10 Words and vowels (lines 2 and 4).

Transcribe from Longhand to Shorthand

Ex. 3. Consonants.
Ex. 5. Joined consonants (lines 1, 3, 5, 7).
Ex. 7. Upward and downward *r* (lines 1, 3, 5, 7).
Ex. 9. Words and vowels.
Ex. 11. Words using long vowels (2, 5, 9, 10).

A mark was given for each accurate transcription of shorthand into longhand and longhand into shorthand. This basis of marking

is not altogether satisfactory, as experts in shorthand will know, but it is sufficiently close to give results accurate in the aggregate.

On the basis of this work the class was divided into two equal groups, and, on November 16, Group A worked the following exercise from 8 to 8:30 p.m. and Group B from 9 to 9:30 p.m. All the rest of the session, before and after the exercises, was occupied with shorthand, as usual. The second exercise was much more difficult than the first.

SECOND EXERCISE

Exercises from Pitman's *Teacher*

Transcribe from Shorthand to Longhand

Ex. 4. (Lines 3 and 5) joined consonants.
Ex. 6. (Lines 3 and 5) joined consonants *r* and ***ch*** combinations.
Ex. 12. Words and vowels.
Ex. 14. Words and vowels.
Ex. 16. Sentences.

Transcribe from Longhand to Shorthand

Ex. 5. (Lines 2, 4, 6). Joined consonants.
Ex. 7. (Lines 1, 3, 5, 7). Upwards and downwards ***r***.
Ex. 9. Words and vowels.
Ex. 11. Words and vowels.
Ex. 13. Words and vowels.
Ex. 15. Words and vowels

The basis of marking was as before.

The results follow:

TABLE X

Showing the Work of Groups A and B compared in Elementary Shorthand (Males)

GROUP A.					GROUP B				
NAME INITIALS ONLY	AGE	OCCUPATION	1ST EX. 8:30 P.M. 2/11/08	2D EX. 8 P.M. 16/11/08	NAME INITIALS ONLY	AGE	OCCUPATION	1ST EX. 8:30 P.M. 2/11/08	2D EX. 9 P.M. 16/11/08
Q. W.	16	Clerk	260	282	W. H.	15	Clerk	267	168
H. W.	16	Clerk	238	168	B. A.	15	Post boy	225	133
B. A.	14	Clerk	186	130	P. A.	15	Messenger	198	122
R. E.	14	Clerk	159	148	W. R.	14	Clerk	160	144
T. E.	14	Reader	150	109	P. M.	15	Publisher's assistant	14	128
F. J.	14	Clerk	142	122	J. H.	14	None	136	112
P. F.	14	Clerk	135	102	S. W.	15	Messenger	135	138
W. J.	15	Messenger	128	73	S. F.	15	Reader	127	70
C. J.	15	Clerk	120	78	L. L.	15	Clerk	113	82
H. F.	15	Messenger	112	90	H. H.	14	Library boy	107	66
S. W.	15	Clerk	102	68	C. R.	14	Telegraph messenger	90	36
			1732	1370				1706	1199

The result is striking. Group B, which started only 26 points below Group A, finishes 171 points below. Group A does not, as in other cases, improve on its previous record; the increase in the difficulty of the exercise was probably the cause of that; but we can compare the decrease in marks shown by the members of Group A with the decreases shown by the corresponding members of Group B; or, a still simpler method, we can compare the actual marks of the members of Group B with the actual marks of the corresponding members of Group A. In 8 cases out of a total of 11, the lad in Group B does inferior work to the boy in Group A with whom, on the occasion of the preliminary exercise, he was found to be approximately equal.

The difference of an hour in the course of the evening appears to produce a very marked difference in the capacity for accurate work, even in work as mechanical as these exercises are said to be.

c. In Advanced Shorthand. (Males)

This was a small class containing eight pupils only, and an absentee on the occasion of the second exercise reduced the numbers available for comparison to six since the corresponding pupil in the other group had, of course, to be omitted. The preliminary exercise was given on November 2, at 8:30 p.m. The second or test exercise, which was easier, was given on November 16 to Group A at 8 p.m., and to Group B at 9 p.m. Half an hour was allowed for each exercise as before. The basis of marking was as before. The problems and the results follow:

PRELIMINARY EXERCISE

Pitman's *Manual*

Shorthand to Longhand

Ex. 42. Sentences. Ex. 48. Sentences.
Ex. 46. Sentences.

FINAL EXERCISE

Pitman's *Manual*

Longhand to Shorthand

Ex. 47. Sentences. Ex. 50. Sentences.
Ex. 49. Words.

TABLE XI

Showing the Work of Groups A and B Comparatively (Males)

Group A					Group B				
NAME INITIALS ONLY	AGE	OCCUPATION	1st Ex. 8:30 P.M. 2/11/08	2d Ex. 8 P.M. 16/11/08	NAME INITIALS ONLY	AGE	OCCUPATION	1st Ex. 8:30 P.M. 2/11/08	2d Ex. 9 P.M. 16/11/08
R. F.	16	Clerk	258	248	W. F.	18	Clerk	297	286
P. W.	17	Clerk	146	191	M. E.	18	Clerk	149	167
W. G.	16	Clerk	67	204	D. A.	17	Clerk	88	184
			471	643				534	637

The absence, above referred to, threw the groups out of balance, and we now have a much stronger group working the exercise at 9 o'clock than at 8 o'clock, but, notwithstanding this fact, the 8 o'clock group does superior work in the final exercise. The difference in the time appears to have caused the members of Group A to catch up 63 points and pass Group B by 6 additional points.

Calculated as percentages of their previous work, the results from these six pupils appear thus on the final exercise.

TABLE XII

Showing the Comparative Increase in the Marks of Groups A and B from the First to the Final Exercise

Group A		*Group B*	
NAME INITIALS ONLY	PERCENTAGE SHOWING INCREASE OR DECREASE	NAME INITIALS ONLY	PERCENTAGE SHOWING INCREASE OR DECREASE
R. F.	96	W. F.	97
P. W.	130	M. E.	112
W. G.	300	D. A.	210
	176		139

The second exercise, as every shorthand teacher knows, was decidedly easy as compared with the first; yet, even on this second exercise, a difference of an hour earlier or later involves a difference in the percentage of increase on the marks of the preliminary exercise of no less than 37 per cent, and, as might be expected, it is the weaker students who reap most advantage from the earlier hour. W. F. is so much the best that it is hard to place him in these groups at all.

d. In Intermediate Shorthand. (Females)

The next class in which the experiments were made was very mixed. It contained one typist, one clerk, two dressmakers (learners), two milliners (learners), one pattern-card maker, one bookfolder, and five pupils who did no work at all. I rather despaired of getting any uniformity of results in a class of this kind, and the evidence shows that my fears were justified; but I thought it well to include such a class, if only for purposes of comparison.

The general method was the same as before—a preliminary exer-

cise at 8:30 p.m. on 2/11/08, and a division into two groups with a final exercise as before. The exercises and results follow; the second exercise is much easier than the first.

PRELIMINARY EXERCISE

Pitman's *Manual*

Ex. 6. Words (half) shorthand to *longhand*.
(half) longhand to *shorthand*.
Ex. 7. Words—shorthand to *longhand*.
Ex. 8. Words—longhand to *shorthand*.
Ex. 9. Words—shorthand to *longhand*.
Ex. 81. (*Reporter*) longhand exercise to shorthand

FINAL EXERCISE

Pitman's *Manual*

Longhand to Shorthand

Ex. 10. Words. Ex. 13. Sentences.
Ex. 12. Words.

Shorthand to Longhand

Ex. 11. Words. Ex. 15. "Hook" Exercises.
Ex. 14. Sentences.

TABLE XIII

Showing the Work of Groups A and B compared. (Females)

Group A					Group B				
NAME INITIALS ONLY	AGE	OCCUPATION	1st Ex. 8:30 P.M. 2/11/08	2d Ex. 8:00 P.M. 16/11/08	NAME INITIALS ONLY	AGE	OCCUPATION	1st Ex. 8:30 P.M. 2/11/08	2d Ex. 9 P.M. 16/11/08
C. C...	16	Bookfolder.....	123	228	H. E.	15	Clerk....	129	absent
W. R..	17	None.....	117	absent	S. L.	16	None....	116	204
M. A...	16	None.....	90	180	C. M.	14	None....	87	215
B. T...	16	Dressmaker	76	167	A. A.	16	Clerk....	86	115
L. E...	14	Dressmaker.....	67	119	P. D.	14	Typist...	69	167
G. Y...	14	Milliner.....	44	69	R. I.	14	None....	33	49
S. A...	14	Pattern card maker	21	25	C. E.	16	None....	23	42
			538	788				543	792

There is obviously no general advantage or disadvantage in the earlier as compared with the later hour so far as this class is concerned. But of *six* pupils in the 9 o'clock section no less than *four* do no work during the day, whilst in the early group only one pupil is without daily work, and she, be it noted, shows an increase of 100 per cent. on her first exercise. The only safe conclusion from the work of this class is that very great care is needed in such experiments as these not to lump together the results of those pupils whose daily work is very different. In other words, classes must be fairly homogeneous before, by class methods of this kind, we can hope to get any definite results at all. That, if we take due precautions, we can obtain, by easy school methods, a series of perfectly valid and uniform results is shown by the whole course of this series of experiments; but I include the last table in the hope that it may check hasty and inconclusive experiments, and also because I hold that in work of this kind every result obtained should be shown, without selection.

6. SUGGESTED CONCLUSIONS

For readers of scientific journals the evidence above adduced will doubtless be sufficient to inspire a strong and definite conclusion. My own would run somewhat thus—*that evening work is comparatively unprofitable, and that a short time in class in the evening is sufficient,* PLUS *the labors of the day, to induce a very low condition of mental energy.*

Evening schools will, doubtless, always find some place in an educational system, recreatively and otherwise; but to me they seem likely to prove unprofitable, if considered as places of seriously continued education for adolescent students. If the definite education of the elementary school pupil is to continue after fourteen years of age, his hours of day labor must at least be reduced, if evening study is to be educationally profitable. I incline to doubt even then whether his mental energy would be satisfactorily sustained during the evening. It is not brightness, nor cheerfulness, nor an interest in novelties which are required, but patient, and rapid, yet unexcitable mental application, dependent, as it certainly is with pupils of this type, upon a generally fresh and vigorous condition.

The long two-hour lessons have, perhaps, played a part in producing the poor results of the work in the later part of the evening; though we have to remember that the telegraph messengers' class was a one-hour class only. Teachers say that students do not care to come for *one* hour's instruction in *one* subject, and that they will not come *two* consecutive nights for *one* hour each; and, doubtless, the present two-hour lessons have many administrative advantages.

Nothing but definite and protracted experiment could tell us whether the shortening of the *lessons* would make the evening school more profitable; but I incline to the view that serious evening study for adolescents would not be very profitable in any case. This, however, is an opinion merely; the only certainty is the comparatively unprofitable nature of the present work under present conditions, due, apparently, to the rapid falling-off of the mental energy of the students as the evening proceeds.

NEW INSTRUMENTS FOR TESTING DISCRIMINATION OF BRIGHTNESS AND OF PRESSURE AND SENSITIVITY TO PAIN[1]

DR. GUY MONTROSE WHIPPLE

Cornell University

For the discrimination of brightness, use has been made of Masson's disc, both by daylight and artificial illumination, of the episkotister, of gray papers, of dyed cloth, and of shadows. All of these devices present technical difficulties, particularly when it is desired so to standardize the material that tests conducted by one experimenter shall be comparable to those conducted by another.

In the search for a method of testing brightness discrimination that should avoid these difficulties and that, at the same time, should demand only simple and relatively inexpensive apparatus, the writer has contrived two new forms of brightness test, the first by reflected, the second by transmitted light.

I. DISCRIMINATION OF GRAYS BY REFLECTED LIGHT

The apparatus for the discrimination of grays by reflected light (Fig. 1) consists of a set of ten test-cards, each composed of two gray strips, 13 x 40 mm., pasted upon a white card 10 x 10 cm. Each card bears one strip of a standard gray and one strip of a darker, comparison gray. As numbered on the reverse side, Card No. 0 represents no difference, or objective equality: Card No. 1

[1] These three instruments were shown at the meeting of the American Psychological Association at Cambridge in December. More explicit directions for their use are contained in the writer's forthcoming *Manual of Physical and Mental Tests*. The instruments may be purchased of C. H. Stoelting, 121 North Green Street, Chicago.

represents the minimal objective difference, Card No. 9 the maximal objective difference.

The grays used on these cards have been specially prepared under the writer's direction by S. L. Sheldon, photographer, of Ithaca, and have been carefully standardized. Every set of grays is printed from the same negative, on which the original series of brightness-differences was formed by a graded, serial exposure before a sheet of milk glass set in a north window. The tones, sizes, and spatial relations of the strips, cards, and background have been selected to minimize errors that might arise from contrast and adaptation. The size of the strips is slightly smaller than that prescribed by Ament (1), 18 × 45 mm., and slightly larger than that prescribed by Titchener, 10 × 40 mm., for the demonstration of Weber's Law in brightnesses.

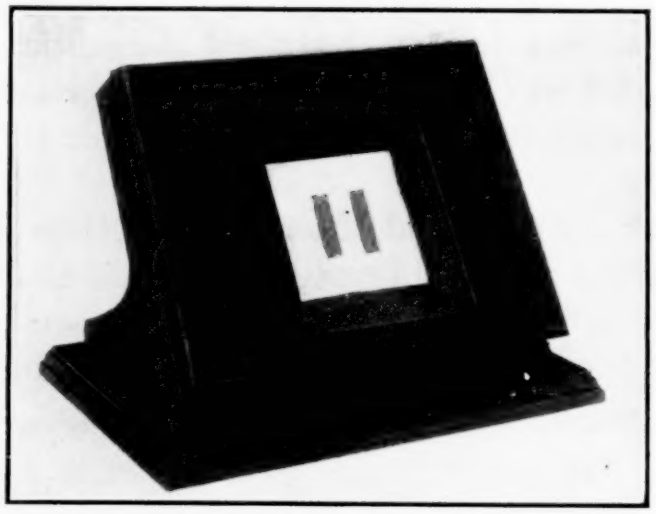

FIG. 1

These test-cards are inserted, one at a time, in the exposure frame, where they lie in a special card-holder of a 'turn-table' pattern, which may be rotated through 180 degrees by means of a knob at the back of the apparatus. They are viewed through an opening (8 x 8 cm.) in the black cover of the instrument.

In use, the apparatus is placed upon a small table, squarely before a north window where good diffuse daylight may be secured. A large gray cloth is first spread over the table and carried up vertically at the back to form a neutral background upon which the observer's glance may rest when he is not regarding the test-

cards. The experimenter then ascertains by methodical procedure the test-card in which the brightness-difference is correctly judged in 80 per cent. trials, taking care, of course, that the darker gray is shown in half of the trials on the right, in half on the left.

II. DISCRIMINATION OF BRIGHTNESS BY TRANSMITTED LIGHT

The apparatus for the discrimination of brightness by transmitted light (Fig. 2) consists of a black box fitted with a 32 C. P. frosted tungsten lamp, the rays of which are reflected from two independently adjustable white screens upon two oblong trans-

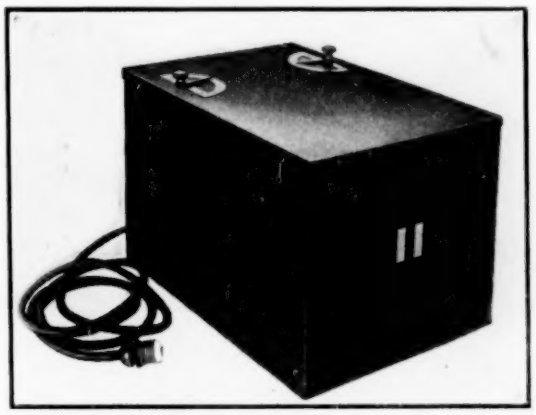

FIG. 2

lucent windows, so placed in the face of the box as to afford the same dimensions and spatial relations as obtain in the gray strips of the instrument first described.

The observer is seated some 50 cm. directly in front of the apparatus, while the experimenter controls the illumination of the windows by suitable adjustment of the levers which move the reflecting screens, and which are provided with scales upon the upper surface of the box. If desired, a red or other colored lamp may be substituted for the frosted lamp, so that discrimination of colors of different brightnesses may be tested.

III. THE PRESSURE-PAIN BALANCE

The testing of discriminative sensitivity for pressure, sometimes known as the test with 'resting weights', depends for its feasibility very largely upon the type of apparatus employed. In particular, variation in the temperature of the weights, in the area and place stimulated, and in the manner of application of the weights must be excluded. To obviate these sources of error, the principle of the 'pressure-balance' has been adopted by several investigators, *e. g.*, Merkel (6), Jastrow (4), and Bolton and Withey (2).

In measuring sensitivity to pain, also, the principle of the balance has been utilized by Gilbert (3) in the construction of a

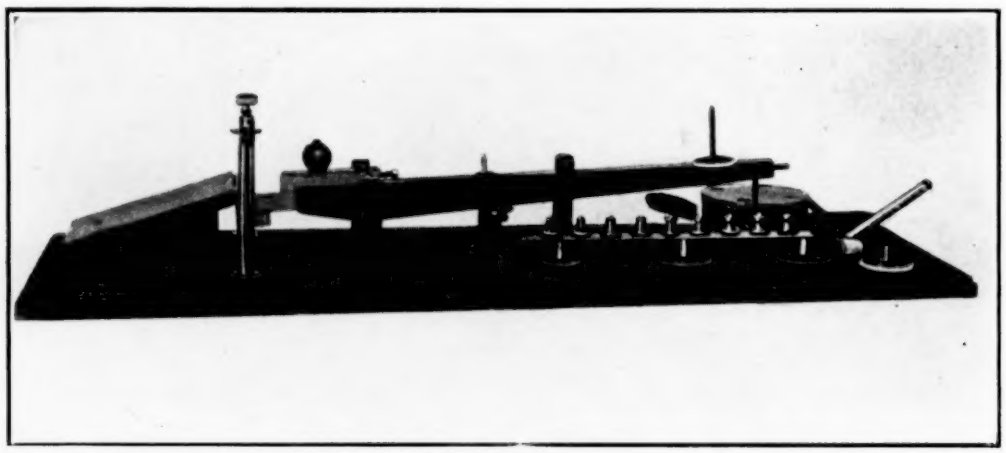

FIG. 3

'balance-algometer.' In this test, the use of the balance makes it possible to control the rate of application of the stimulus, a feature which is virtually lacking in the algometers of Cattell and MacDonald (5), but which is essential to the conduct of the test.

The writer's pressure-pain balance (Fig. 3) is designed to embody in a single instrument all of the features necessary for the control of the application of the stimuli, both in testing discrimination of pressure and in testing sensitivity to pain.

The instrument consists of (1) a hand-rest, (2) a fixed cross-bar carrying an adjustable vertical screw whose hard-rubber terminal constitutes the stationary pressure-tip, (3) a balanced beam,

which carries the movable pressure-tip and upon which the stimulus-weights are placed, (4) a cam and lever for regulating the movement of the beam, (5) a set of weights for standard and increment pressures, (6) a set of large disc weights for pain tests, and (7) a lever-device for lifting the increment-weights from the beam when desired.

In operation, when testing discrimination of pressure, the subject's finger tip is placed directly under, and in contact with, the stationary pressure-tip. A weight, marked B-100 g., is placed upon the pin (marked *B* on the instrument) at the outer end of the beam. This weight is not removed during the experiment, and constitutes the standard stimulus, 100 g. Upon the second pin, (marked *A* on the instrument) is placed any desired increment-weight (a range of 1 to 69 g. is provided). These increment-weights are added to the standard stimulus when they rest upon the beam at *A*: they are subtracted at will from the total pressure by depressing the increment-weight lever, which lifts them from the beam, and allows only the standard stimulus to be operative. The several pressures are applied to the finger by moving the lever at the extreme right of the instrument up to the left, so as to depress the support beneath the beam. The instrument is noiseless, convenient, easily operated, and simple in construction. With practice the pressures may be applied perfectly evenly and as rapidly as is desirable for optimal discrimination.

When this instrument is used for measuring sensitivity to pain, the cam support is, preferably, permanently depressed, and the larger weights, each of which produces 200 g. pressure upon the finger tip, are applied at the rate of one in two seconds upon the pin *B*. The pressure is, therefore, cumulative and increases at a uniform and predetermined rate. The application of the weights continue until the observer reports the first experience of real pain, as distinct from strong pressure or discomfort.

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(4) J. JASTROW. *On the pressure sense.* Amer. Jour. Psych., **3**: 1890, 54-6. (Jastrow's instrument is figured in Sanford, A Course in Experimental Psychology, pp. 417-8, and in Titchener, Experimental Psychology, vol. ii., Part ii., p. 136.)

(5) A. MACDONALD. *Experimental study of school children.* Rept. U. S. Comr. Educ., 1897-8, ch. xxi, pp. 1155 and 1161 (Cattell's algometer).

(6) J. MERKEL. *Die Abhängigkeit zwischen Reiz u. Empfindung.* Philosoph. Studien, **5**: 1889, 245.

ABSTRACTS AND REVIEWS

FRANCIS GALTON, F.R.S. *Memories of My Life.* (New York: E. P. Dutton & Company. 1909. Pp. 331).

A charming account of a charming personality, a book in which a notable man of science recounts all too briefly the development of the more important phases of his many-sided life. Galton's parentage, childhood and boyhood are sketched in two short chapters: his medical studies and his life at Cambridge occupy two more: his geographical interests—travels in Egypt, the Sudan, Syria, Southwest Africa, etc.—are the subjects of some half-dozen chapters. In other sections attention is paid to the establishment of the Kew Observatory, and to the work of the British Association, here, as elsewhere, with abundant anecdote and reminiscence.

Psychologists and educators will, however, peruse with most immediate interest the last five chapters in which Galton explains how he came to develop anthropometric laboratories, to try composite portraiture, to investigate number-forms, to invent the method of centile-grades, to exploit the possibilities of arithmetic by smell, and in which, generally, he surveys the progress made in the measurement of mental traits, and in our understanding of the principles of heredity. He declares that the leading principles of the modern eugenics movement, with which his name is so closely associated, are essentially the same as those he expressed as long ago as 1865, and in his closing paragraphs he says:

> "I take Eugenics very seriously, feeling that its principles ought to become one of the dominant motives in a civilized nation, much as if they were one of its religious tenets." . . . "Natural selection rests upon excessive production and wholesale destruction; Eugenics on bringing no more individuals into the world than can be properly cared for, and those only of the best stock."

The book is well printed, contains eight illustrations, including two recent autograph photographs of Galton. The list of his 182 contributions to science, chronologically arranged, is unfortunately misnumbered so that all numbers above 75 must be reduced by one to correspond with the references in the text.

G. M. W.

DR. MADISON BENTLEY. *Mental Inheritance.* Popular Science Monthly, 75: November, 1909, 458–468.

J. F. BOBBITT. *Practical Eugenics.* Pedagogical Seminary, 16: September, 1909, 385–394.

Bentley's paper is an address delivered before the Cornell University chapter of the Sigma Xi, in which the problems of heredity are explained, and the methods by which psychology, in particular, can attack these problems are discussed. The author shows that we have no evidence that mental capacity has kept pace with social accumulation: rather, "as regards mental endowment, we begin very much as our distant forbears began." The present eugenics movement looks toward an improvement of mental capacity, and therefore assumes that mental capacity is heritable. Of the two main lines of work upon heredity in biology—biometry and the qualitative analysis of unit characters (as in the work of the Mendelians)—psychology has thus far made use primarily of the first alone, e. g., in the biometrical methods of Francis Galton. These methods have proved, to be sure, that mental ability depends in large measure upon direct inheritance, but we are forced to be more specific; we wish to know more exactly the degree of inheritance of particular mental abilities just as the biologist seeks to measure the degree of inheritance of particular bodily organs. So far, investigators of mental inheritance have, in their search for these specific mental characters, fallen back upon such gross terms of popular psychology as "sound judgment," "temper," "conscientiousness," etc., e. g., in the work of Pearson and of Heymans and Wiersma. "But," asks Bentley, "cannot this method be improved?" The work of Mendel surely suggests to psychologists that mental inheritance must now be studied "not in the gross, but in terms of definite and measurable mental structures and functions." Psychology must develop a "doctrine of mental characters" in place of the "popular conception of vague and indefinite traits." This means that the psychology of individual differences must be carried forward by persistent and careful use of the methods of mental measurement that are now in process of development, that fundamental differences in mental formation must be discovered, that these differential factors must then be integrated, so that, finally, a scientific classification of mental types may be secured. Mental heredity opens a fertile field for investigation, and it holds out a promise of rich reward. "Eugenics rests upon a scientific basis . . . . Whatever differences

of opinion we may hold regarding the probable success of its methods, we must agree that civilized man may not indolently regard himself as 'God's domestic animal.'"

Bobbitt's paper is an address delivered at the Conference on Child Welfare, Clark University, July, 1909, and is devoted to a consideration of the ways in which "God's domestic animal" may improve himself. We are coming, says Bobbitt, to see that "a child cannot be molded to our will," that "human plasticity is not so great as has been assumed." In our present civilization two sinister influences are at work: "the upper and better strata of society are continually dying away, and poorer ones are being added on at the bottom." The more highly endowed classes furnish a smaller proportion of the coming generations: the more poorly endowed, the weaklings and the stupid are kept alive by our medicine, our hygiene, our public sanitation, and our charities, and are nursed and cherished in our schools. In earlier days, the blood of the race was kept high and pure by the fierce struggle for existence, but our racial stock is now unweeded. Hence the practical task of eugenics is to check these double ravages, to reverse nature, as it were, by encouraging strong and capable men and women seriously and consistently for long generations to undertake parentage, and by preventing the weak from mingling their weakness in human currents.

The writer reviews the measures that have been proposed for racial purification, e. g., the repression of the unfit by stringent marriage laws, by the segregation of the unfit, by the sterilization of criminals and defectives, or even by the abolition of all public agencies (charities, school systems, etc.) that tend to preserve the incapable. This last proposal is too drastic: the first is good, but insufficient: in general, public opinion must be educated up to any repressive measure.

Positively, economic legislation has been proposed to encourage fecundity (taxing the unmarried, paying bonuses to large families, etc.), but the evil is not primarily economic. If it could be infused into men, a greater potency would reside in the "eugenic religion" proposed by Galton, but this requires a degree of altruism never yet possessed by any religion.

G. M. W.

C. S. BERRY. *An Experimental Study of Imitation in Cats.* Journal of Comparative Neurology and Psychology, **18**: 1908, 1–25.

This paper gives an account of some experiments which were made to determine how far imitation is a factor in the learning processes of the cat. The work follows the same lines as the author's previous study of imitation in white rats.[1] The subjects were four Manx cats, a mother cat and three kittens. all of whom were alert and active. The method followed was to give each animal an opportunity to perform a certain act or series of acts and if it failed, to give it a chance to learn by watching another animal do the deed. In each case of successful performance the animal obtained food.

Nine different problems were set for the cats to solve: (1) jumping from box to table; (2) opening door by pulling knot; (3) opening door by turning button and pulling loop; (4) getting food by turning button; (5) raising small trap door; (6) rolling ball into hole; (7)learning to catch mice; (8) getting meat out of a bottle; (9) getting down from top of cage.

In these experiments many instances of imitation occurred. The author classifies them as (1) instinctive imitation, (2) voluntary imitation, (3) automatic imitation. In examples of the first, instinctive imitation, one cat performed the same act as an another cat without having had an opportunity to form an association with the reward to be obtained. Voluntary imitation occurred more slowly and usually as the result of seeing the trained cat perform the act and get food many times. Frequently the imitator also obtained food as the result of the first cat's act. No evidence of voluntary imitation was found in cases where the imitator only observed the performance of the act from another compartment. In cases of automatic imitation one animal which had already acquired the habit of performing a certain act would repeat it after seeing another cat do the same thing. This last the author considers important in the life of animals, which are more dependent than man upon external stimuli, in that it enables them to retain and profit by their past experience.

The author notes also that many times the imitation was not exact; for example, in doing the same act one animal would use teeth and another claws. "Certain elements of a given complex are likely to be singled out and these enter into the association to the exclusion, in large measure, of other elements."

[1] The Imitative Tendency of White Rats. Journal of Comparative Neurology and Psychology, 1906, **16**, 333-361.

One interesting feature of the experiments is Doctor Berry's conclusion that his cats, at least, did not instinctively kill and eat mice but learned to do so by imitation. It may be that many other so-called instincts in animals are really the result of early training and experience. This fact should also make one hesitate in dealing with human beings to ascribe too much importance to instinct or heredity without a thorough knowledge of early environmental conditions.

The immensely important part which imitation plays in the lives of children is known but perhaps too little appreciated by educators. Doctor Berry's work should serve to stimulate many interesting and precise investigations of imitation in children.

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Cambridge, Mass.

HAGGERTY, M. E. *Imitation in Monkeys.* Journal of Comparative Neurology and Psychology, **19**: 1909, 337-445.

Imitation has always been assumed to be an influential factor in the mental development of monkeys. Many stories have been recorded of monkeys who voluntarily imitated human beings. Mr. Haggerty, in his paper on imitation in monkeys has described a series of careful and exact experiments made to determine to what extent monkeys voluntarily imitate one another. The general method employed is the same as that followed by Doctor Berry in his work with rats and cats. The animals used were eleven monkeys belonging to the two genera Cebus and Macacus and to seven different species. They varied in age, sex and individual characteristics. The apparatus consisted of a large cage built in sections; the sections contained different devices for testing the ability of the animal to obtain food for itself either independently or through watching another animal do so. The various devices were used in experiments designated as follows: (1) chute experiments A and B; (2) rope experiment; (3) paper experiment; (4) screen experiment; (5) plug experiment; (6) button experiment; (7) string experiment.

These seven experiments yielded a total of sixteen cases of successful imitation and five of partially successful imitation. Of the eleven monkeys two showed no tendency toward imitative behavior, two succeeded in some tests and failed in others, and the remaining seven were successful in every experiment given them. All of these cases come under the head of voluntary imitation but the author describes four well-defined "levels of imitative behavior." The first is characterized by the arrest

of attention, due usually to the movement of the animal imitated. In the second the imitator begins to follow the trained animal. A higher form is that in which the imitator attacks a definite object associated with the getting of food, and only gradually acquires the necessary skill to perform the proper act. The most perfect form of imitation is the exact repetition in detail of the act of another animal.

The author calls attention to the evidence that not only the act of the trained animal but also the profitable result of that act was a necessary factor in producing imitation.

The fact that monkeys stand nearest to man in the phylogenetic scale make these experiments of special value. to those who are interested in racial development.

ADA W. YERKES.

Cambridge, Mass.

S. S. COLVIN. *The Ideational Type of School Children.* Pedagogical Seminary, September, 16: 1909, 314–323.

Previous investigations of ideational type have, in Colvin's opinion, been inconclusive, in part because the concept of types has been too gross (normal individuals are never exclusively visual or auditory-minded: the same individual uses different forms of imagery for different forms of thinking, etc.), and in part because we have had no standardized or reliable tests for the qualitative or quantitative determination of the types that do exist. The best tests for adults are doubtless those that are essentially introspective, but for children whose introspection is scanty and unreliable, the best form of test is probably that which employs an "indirect" method.

Dr. Colvin reviews briefly the experiments of Netschajeff, Pohlmann, Lobsien, Lay, Pentschew, Hawkins, Kirkpatrick, Pfeiffer, Pedersen, and Meumann, and describes his own tests of 700 school children and college students. The following are among the conclusions drawn: (1) "Writing, instead of being an aid to learning, is for children up to 10 years of age, a distraction." (2) "Children of the lower grades think predominatingly in concrete imagery, which in most instances is visual." (3) "This concrete imagery gradually falls off and is replaced by verbal imagery." (4) The concrete imagery of childhood aids recall in memorising by facilitating the stamping-in (Einprägung) of impressions, whereas

the subsequent verbal imagery of maturer years "facilitates that aspect of recall which depends on association."

These conclusions, Colvin believes, have an important bearing upon the economy of learning. Defective imagery may handicap school progress as much as defective sense-organs. The normal, as well as the backward, child would profit if his instruction were better adapted to his mental type. A systematic determination of each child's type should be made from year to year.

G. M. W.

C. H. JUDD. Journal of Philosophy, Psychology and Scientific Methods, three articles: (1) *Doctrine of Attitudes*, **5**: 1908, No. 25, 676–684; (2) *What is Perception?* **6**: 1909, No. 2, 36–44; (3) *Motor Processes and Consciousness*, **6**: 1909, No. 4, 85–91.

Reviewers often make mistakes. Some of the mistakes are made through carelessness, others through lack of knowledge. If the mistakes are of the former type, the reviewer should be censured or admonished; if of the latter, he should merely be enlightened. Such would seem to be the attitude of Professor Judd towards reviewers, for he has written the above three articles to clear away certain misconceptions with which some of them who reviewed his *Psychology: General Introduction* seemed to be possessed.

The *Doctrine of Attitudes* is an elaboration of the explanation of feelings as put forward in his book. The threefold classification of mental life into volitions, cognitions, and feelings is shown to be unsatisfactory from two points of view: (1) the classification gives no real place to such important aspects of mental life as interest and attention; and (2) it is very defective with regard to its treatment of feeling. Any elaborate analysis of feeling by psychologists has led to endless confusion. While it is easy to discern the difference between cognitions and volitions, it is found to be extremely difficult to discriminate between feelings on the one side, and cognitions and volitions on the other. Feelings according to one class of psychologists, must be analyzed into sensation elements before they can be known; to another they are identical with sensations; while to a third they are the preliminary steps towards volitional ends.

These troublesome difficulties are overcome by breaking away from the traditional threefold classification and substituting a new twofold classification—subjective elements and objective elements. These two,

while fundamentally different in character are vitally related to each other very much in the same way that force and matter are related. In this classification volitions, feelings, interest and attention are subjective, while sensations and cognitions are objective elements. That feelings can be recognized as distinct from sensory impressions is proven by striking a chord repeatedly. The sensory impression in all cases is practically the same—feelings are subject to great fluctuations. Hence feelings are defined as subjective reactions or attitudes, with which the individual meets the sensory impressions which go to make up his cognitions. Attitudes in general are subjective reactions which originate within the individual rather than in objective conditions.

The central idea of the second article *What is Perception* is that in perception we do not get a series of added factors; that perception is not a sum of the sensory elements of which it is composed, but rather that it is a simple, direct, compact, immediate process of recognition dependent for its explanation upon present conditions here and now at hand. Instead of an addition of factors we get a substraction of factors with the place of the latter taken up by functional activities or tendencies toward reaction. To look upon the perceptual process as conditioned by an elaborate form of reasoning is to grossly misunderstand the economy of mental life, for percepts are advantageous just because they are simple and direct.

In the third article the person reviewed turns reviewer. Dewey's and McDougall's conceptions of the parts played by the motor processes in consciousness are found to be too general to give a definite answer to the question "what modification in consciousness will result from a modication in the motor outlet of a given stimulation?" Münsterberg, Royce and Baldwin, on the other hand, have advanced theories which are not sufficiently comprehensive. "One needs," says Judd, "a formula which is at once comprehensive and capable of application to specific cases of various kinds." The formula according to Judd is that mental organization and unity are always motor in character; and that percepts and ideas are due to distinctive motor processes. Thus Judd would say that if two things are recognized as alike it is not through identity of retinal excitations, but that the retinal sensations (which, by the way, are never identical) act as a cue to reactions of the same type. Any retinal impression will do if it gives a cue for right action. Only in this way could we pass through life with its infinitude of sensations without becoming hopelessly confused.

PETER SANDIFORD.

Teachers College.

E. L. THORNDIKE. *A Note on the Specialization of Mental Functions with Varying Content.* Journal of Philosophy, Psychology and Scientific Methods, **6**: 1909, No. 9, 239–240.

At one time the mind was looked upon as a non-differentiated unity. The mind, like a gas bag or tank of water, was supposed to be equally affected throughout by a disturbance of any given part. Next came the faculty psychology which divided up the mind into a series of segregated compartments, one for reasoning, another for memory, and so forth. Investigation of pathological cases pointed to the fact that it was more than probable that the simplicity of the mind was wholly a myth. But it was not until the statistical interpretation of experimental psychological data by Thorndike and others that the extreme complexity of the mind and the independence of the various capacities was realized.

In early investigations Thorndike had neglected to take into account the reducing influence of chance variations in the original measures upon his inter-correlations. He now wishes to see what kind of results would be obtained if he allowed for, or removed this disturbing factor. The test was to draw (1) a line equal to a 100 mm. line; and (2) a line equal to a 50 mm. line. The relation between the accuracies of the two series was calculated. The records were obtained for 30 trials for each length with 37 individuals, young women from 19 to 23 years of age, all in the same class and all very closely of the same degree of mental maturity. The probable true correlation was +.77. This means that the accuracy in drawing a 50 mm. line is only 77 per cent of the same person's accuracy in drawing a 100 mm. line. Or, in other words, the chance of the accuracy in drawing a 50 mm. line equaling the accuracy in drawing a 100 mm. line is as 77 : 100. Since the correlations of the mental or the physical traits of twins are in the neighborhood of +.78 a woman's ability to equal 100 mm. lines is so little or no more like her own ability to equal 50 mm. lines than it is like her own twin sister's ability to equal 100 mm. lines.

> Such a state of affairs seems preposterous. But the fact remains and, until more elaborate measures are made, it must apparently be accepted. . . . . Our traditional psychology has been unable to deduce even very simple relations, and this inability implies that it does not know what the functions are which it names and pretends to describe.

PETER SANDIFORD.

Teachers College.

C. H. JOHNSTON. *Tendencies in College Departments of Education.* Educational Review, **38**: September, 1909, No. 2, 186–190.

Professor Johnston has examined eighty catalogues, representing six state and two endowed universities for the ten years, 1897–1907, with the purpose of determining prevailing tendencies in the departments of education. He finds that there is still much overlapping of courses and much confusion of nomenclature. This lack of clear definition in educational science indicates a lack of effective organization of subject matter; hence one is not surprised to find that, while Ph.D. men are more numerous in the professional ranks than ten years ago, most of the Ph.D. material has been drawn from other departments. The proper relation of psychology to education seems still to be a matter of uncertainty, for the psychological aspects tend to be either over-emphasized or under-emphasized in most institutions. It is also interesting to note (and comforting or otherwise according to one's point of view) that the Herbartianism that was so widely dominant in educational psychology ten years ago is being discarded in favor of the functional and genetic methods of approach. Professor Johnston believes that the elective system has militated against the proper preparation of students of education in the basic disciplines of biology, psychology, sociology, and history.

W. C. B.

R. P. FALKNER. *Retardation: Its Significance and Its Measurements.* Educational Review, **38**: September, 1909, No. 2, 122–131.

The recent studies of Ayres, Cornman, and others upon "retardation" in the lower grades, like the earlier investigations of Thorndike, have stimulated public-school men to examine critically the data upon which these studies are based and the methods by means of which their conclusions have been reached. In this article Dr. Falkner comes gallantly to the rescue of the statisticians and takes issue very sharply with some of their critics. His rejoinder is directed chiefly against Greenwood's contention that the retardation investigations have employed an "age standard" for their determinations rather than a "progress standard." The former is based upon the number of pupils in each grade who are above the normal age for that grade. This may mean, of course, that pupils were late in entering school, or it may mean that their progress in school has been retarded. The "progress standard," on the other

hand, is based upon the length of time that it takes a pupil to do a year's work, and consequently measures real retardation much more accurately.

Falkner analyzed the statistics of several city systems, applying the "progress standard." So far from discrediting the conclusions of the statisticians, based on the "age standard," his results show an even more alarming condition. In the city of Boston, for example, *46 per cent.* of the class graduating from the grammar schools in 1897 required more than the stated period to cover the elementary course, while, for the same year, the age-retardation in the fourth-grade classes of the same system was only a fraction over *29 per cent.* A similar condition is found in all of the cities examined except one.

It seems to the reviewer that a collection of statistics of retardation in foreign schools, and especially in German schools, should be next in order in this series of investigations. If we are worse than Germany in this respect, it can scarcely be maintained that retardation is due entirely to mal-nutrition, unhygienic conditions, or the lack of a content that will stimulate pupils to effort. While these factors are doubtless operative, it is barely possible that some blame must be attached to the fact that "keeping pupils back" is often the only effective method that American teachers can resort to in order to maintain the required standard.

W. C. B.

JOHN DEWEY. *Moral Principles in Education.* (Boston: Houghton Mifflin Company, 1909. Pp. x, 60. 35c.)

We must distinguish between moral ideas and ideas of morality; between moral education and direct moral instruction. In the moral training given by the school community, we should not permit the training which tends to be narrow, pathological and formal; school life should train for many social relations and develop self direction and leadership in school activities typical of social life. In the moral training from methods of instruction, we should seek active social service, inculcate positive motives and standards, and center interest in present activities as opposed to remote success as an end. The course of study influences the conduct of the school, is the means of realizing social situations, represents merely phases of a unified social life, is controlled by social considerations, presents typical phases of social development, offers contrast and consequently perspective, and teaches the methods of social progress. This is illustrated in history, geography, and mathematics.

Psychologically, conduct is a mode of individual performance; native instincts and impulses are the sources of conduct; moral ideals must be realized in persons; character is a system of working forces; force is a necessary constituent of character and implies intellectual judgment, good sense, and delicate emotional responsiveness. The school must be judged by ethical standards.

Thus runs the argument in this forceful and sound little manual on *Moral Principles* which is an interpretation of consistent psychology, ethics and sociology with reference to moral education in the school.

C. E. S.

J. PAYOT. *The Education of the Will: the Theory and Practice of Self-Culture.* Authorized translation by S. E. Jelliffe. (New York and London: Funk and Wagnalls, 1909. Pp. xxiv, 423.)

This is an English translation of a well-known French book which, appearing first in 1893, reached its twenty-seventh edition in 1907. M. Payot, who is rector of the Academy of Aix, addressed his book especially to students. It is written in an easy, fluent style, replete with concrete illustrations. Its psychology is that of the orthodox French school, and the book is dedicated to Ribot. Its value, however, lies in the wholesome character of the advice that it gives to young people. Especially noteworthy is the frank manner in which the author warns his young readers against the sophisms of the sensualist. High-school principals who are seriously attacking the problem of chracter-building will find the book very suggestive.

W. C. B.

NOTES AND NEWS

In a recent number of *Science* a writer urges the establishment by the United States government of experimental schools, similar to the agricultural experiment stations now found in almost every state. It is argued that vastly more important results would accrue from such systematic experimental human culture than from the experimental agriculture, the value of which is now so generally recognized.

Prof. E. B. Titchener has been appointed Sage professor of psychology in the recently established Graduate School of Cornell University. Professor Titchener is to be free to devote his attention exclusively to research work.

Educators in Italy are discussing the reform of the Normal School. They demand an extension of the course of study, in order that their teachers may be provided on the one hand with a broader cultural foundation, and on the other with a more adequate professional training. The situation is complicated by the fact that the Normal School is practically the only secondary school for women in Italy. The discussion seems to center at present about the relation of the Normal School to the University.

The Institute of Experimental Psychology and Pedagogy of Milan recently signalized the successful completion of its first year. The Director of the Institute, Professor Treves, has been greatly assisted in his work by the active collaboration of the teachers of Milan, and has thus been able to place at the disposal of the schools the technique and equipment of modern psychological research.

According to *Science* an excellently equipped laboratory devoted to experimental psychology has recently been opened at the University of Oxford, and efforts are being made by the University of Cambridge to increase the facilities for experimental psychology in that institution by the erection of a new laboratory. An offer of $15,000 has been made on condition that the building is begun without delay.

The psychological clinic of the University of Pennsylvania has greatly extended the range of its activities this winter. Arrangements have been made whereby teachers and parents throughout the State of Pennsylvania may receive advice on cases of retarded children through the medium of correspondence, and lecturers are sent out to address teachers' meetings and to give suggestions as to the proper treatment of defectives.

Dr. J. W. Baird, professor of psychology in the University of Illinois, has been called to Clark University to occupy the position recently made vacant by the appointment of Professor Sanford as President of Clark College.

The faculty of Middlebury College, Middlebury, Vt., announces a new, four-year pedagogical course beginning next September.

Prof. Karl Pearson of London is at present engaged in the collection of statistics by means of an elaborate questionaire on the relative importance of heredity and home environment in the development of children. Professor Pearson expects to have his results ready for publication by May, 1910.

An arrangement has been effected by Teachers College, Columbia University, whereby professors may be absent on leave during the regular year for a period equal to the time spent in teaching in the summer school. As a result a fuller offering of courses is made for next summer than ever before in the history of the school. Among those giving courses are Professors Thorndike, Monroe, Dewey, McVannel. McMurray, Strayer, Johnson, Smith, and Dow.

The Department of Superintendence of the National Educational Association meets at Indianapolis, March 1, 2 and 3, 1910. The following societies will meet at the same time and place; the Society for the Scientific Study of Education, the Society of College Teachers of Education, the National Convention of Agricultural Education, the American Physical Education Association, The American School Hygiene Association, the Public School Physical Training Association and one or two others.

We regret to record the death of Dr. William T. Harris, United States Commissioner of Education, 1889 to 1906, author of *The Psychologic Foundations of Education*, and one of the most prominent figures in the educational world.

Another advance in legislation on eugenics is reported from Connecticut where a bill has been passed providing for surgical operations to prevent procreation by those persons who would produce children with an inherited tendency to crime, insanity, feeblemindedness, idiocy, or imbecility. Similar laws have been enacted in Michigan and Indiana.

Philadelphia is trying an experiment with 2400 pupils in eight schools to determine whether the provision of a nutrious midday lunch of soup, milk, and rolls will affect an appreciable improvement in the physical condition and intellectual efficiency of the pupils. In four schools there will be uniform and systematic feeding, in the other four 'control' schools the pupils will continue to pick up food or go without as they have in the past. If the experiment warrants it, the Board of Education may institute a system of lunches to be served free or at a minimal cost.

PUBLICATIONS RECEIVED TO JANUARY 1, 1910.

ELIZA R. BAILEY and JOHN M. MANLEY, Ph. D. *The Teaching of Spelling.* Pp. 16. *The Bailey-Manley Spelling Book.* Pp. 154. Boston: Houghton Mifflin Company, 1908. 25c.

GEORGE HERBERT BETTS. *The Distributions and Functions of Mental Imagery.* Teachers College, Columbia University, Contribution to Education, No. 26. New York: Teachers College, 1909. Pp. 99.

A. S. DRAFER. *American Education.* Boston: Houghton Mifflin Company, 1909. Pp. x, 383. $2 net.

CHARLES W. ELIOT. *Education for Efficiency and the new Definition of the Cultivated Man.* Boston: Houghton Mifflin Company, 1909. Pp. viii, 58. 35c.

ISABEL MCISAAC. *Bacteriology for Nurses.* New York: The Macmillan Company, 1909. Pp. xii, 179. $1.25 net.

W. A. MCKEEVER. Home Training Bulletins: No. 1, *The Cigarette-Smoking Boy,* pp. 11; No. 2, *Teaching the Boy to Save,* pp. 14; No. 3 *Training the Girl to Help in the Home,* pp. 15; No. 4, *Assisting the Boy in the Choice of a Vocation.* Chicago: The A. Flanagan Company, 1909. 5c. each.

HENRY RUTGERS MARSHALL. *Consciousness.* New York: The Macmillan Company, 1909. Pp. xv, 685. $4. net.

S. H. ROWE. *Habit-Formation and the Science of Teaching.* New York: Longmans, Green and Company, 1909. Pp. xvii, 308.

ELEANOR HARRIS ROWLAND. *The Right to Believe.* Boston: Houghton Mifflin Company, 1909. Pp. xv, 202. $1.25 net.

P. SOLLIER. *Le Doute.* Paris: F. Alcan, 1909. Pp. viii, 407.

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